NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

OPTICAL LASER TECHNOLOGY AND ITS APPLICATION
TO DEFENSE MANPOWER DATA CENTER'S (DMDC)
QUERRY FACSIMILE (QFAX) DATA BASE SYSTEM

by

Mark Keller Brown

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Thesis Advisor: Barry Frew

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Optical storage technology is in the headlines as one of today's newest and most promising technological advances. It holds the capability to increase the amount of data stored on a single 5 1/4-inch disc from 1.2 Megabytes (Mb) to 640 Mb! The three basic types of optical disks, Compact Disk-Read Only Memory (CD-ROM), Write Once, Read Many (WORM), and erasable optical, each have their own application niche. For this reason, it is critical for managers to analyze present systems carefully prior to seeking optical storage solutions. An in-depth evaluation of performance and interfacing requirements of currently marketed optical systems was performed. That evaluation was used in the process of determining if Defense Manpower Data Center's (DMDC) Querry Facsimile (QFAX) System, a system of nine databases currently stored on a direct access storage device (DASD), was a candidate for an optical storage application. Additional consideration was given to industry standards for optical devices. A detailed analysis of the current system configuration and end-users requirements was made to determine acceptability of optical systems interfaces and associated capabilities.

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Optical Laser Technology, and Its Application to Defense Manpower Data Center's (DMDC) Querry Facsimile (QFAX) Database System.

by

Mark K. Brown
Lieutenant Commander, United States Navy
B.S., University of Tennessee (Knoxville), 1975

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Author: _____
Mark K. Brown

Approved by: _____
Barry Frew, Thesis Advisor

_____
Robert Prince, Second Reader

_____
David R. Whipple, Chairman, Administrative Sciences

_____
Kneale T. Marshall
Dean of Information and Policy Sciences

ABSTRACT

Optical storage technology is in the headlines as one of today's newest and most promising technological advances. It holds the capability to increase the amount of data stored on a single 5 1/4-inch disc from 1.2 Megabytes (Mb) to 640 Mb! The three basic types of optical disks, Compact Disk-Read Only Memory (CD-ROM), Write Once, Read Many (WORM), and erasable optical, each have their own application niche. For this reason, it is critical for managers to analyze present systems carefully prior to seeking optical storage solutions. An in-depth evaluation of performance and interfacing requirements of currently marketed optical systems was performed. That evaluation was used in the process of determining if Defense Manpower Data Center's (DMDC) Querry Facsimile (QFAX) System, a system of nine databases currently stored on a direct access storage device (DASD), was a candidate for an optical storage application. Additional consideration was given to industry standards for optical devices. A detailed analysis of the current system configuration and end-users requirements was made to determine acceptability of optical systems interfaces and associated capabilities. *Keywords: Information for Use; Interactive online data bases. Theses. (edc)*

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I. INTRODUCTION/BACKGROUND

A. TECHNOLOGY BEFORE APPLICATION

Over the past five years technology has been advancing at a phenomenal rate. The growth rate has been so rapid that applications for the developed technology laps a period of approximately five years. In other words, *we are still developing applications for technological advances we made five years ago.* As a result, the present tendency toward technology developed today is viewed cautiously, since most organizations are still playing catch-up in the automation field. More and more organizations are closely scrutinizing new advances in terms of their business needs. The widespread use of computers has caused an onslaught of newer and better products in the computer arena — and it all costs money!

Optical storage technology is in the headlines as one of today's newest and most promising technological advances. It holds the capability to increase the amount of data stored on a single 5 1/4-inch disc from 1.2 Mb to 640 Mb! It represents an advance of approximately five hundred fold. This advance, however; does not come without its share of added complexities and costs.

B. DOD LIMITED RESOURCES

The Department of Defense (DOD) as well as many private and public organizations have entered the "Information Age" under the added pressure of stringent fiscal constraints. The dual pressures of increasing efficiency and reducing costs simultaneously combined with a market flooded with time

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saving, efficient, automated computer systems has sent most organizations spinning into a whirlwind of a new type of business — the business of analyzing their business.

C. IMPORTANCE OF COMPLETE ANALYSIS

Effective operation of business today, private or governmental, requires a thorough understanding of the business functions and the information required to support each business function. The availability of many products in the information support arena has made it impossible to make correct decisions for that support prior to detailed analysis of functions. The introduction of optical data storage systems has promise for many organizations in terms of massive data archiving, access, and storage. It brings with it the added chore of learning yet another method for storing, processing, accessing and managing information.

D. IMPACT OF STANDARDS

At the present time, technical standards pose the largest hurdle to jump for optical storage devices. Some organizations in the past, filled with the hopes of possessing the latest and greatest information processing equipment, discovered too late that it did not meet their expectations in terms of compatibility or capability. Other organizations discovered too late that what they expected was not included in the base price. Most organizations have had to learn how to implement new technology the hard way. These are some of the reasons optical storage devices have not been the "hot seller" many had hoped they would be.

E. OBJECTIVE

As a result of the factors stated above, this thesis is a requirements analysis of the Query Facsimile (QFAX) File, maintained and managed by Defense Manpower Data Center (DMDC), for its transition from combined storage on magnetic tape and direct access and storage devices (DASD) to optical media.

F. RESEARCH METHODOLOGY

The research began with the gathering of literature (most of which resided in magazines and periodicals) in an attempt to grasp a general picture of this quickly growing technology. It was very difficult to separate fact from fantasy and "real" hardware from proposed, in the final development stages, soon to be on the market, "announceware". Once the real market items were identified, their capabilities were matched with the requirements of the QFAX system. Throughout the thesis, the QFAX system was treated as if it were the only file that needed the unique capabilities available only through optical storage. It was viewed as a standalone test case for the organization to experiment with prior to a decision to commit all applicable files to an optical medium. In addition to looking at an optical application for QFAX, a general look at other DMDC files revealed possible expansion of the optical devices to accommodate other files in the future.

In general, DMDC must consider the future expansion of its data and decide if the solution to the growing data (as well as backup and archival data) will be more physical space for tapes and more drives or a transition from magnetic tape to optical storage.

II. WHAT IS DEFENSE MANPOWER DATA CENTER (DMDC)? [Ref. 1]

A. ORGANIZATIONAL POSITION

DMDC's place within the Department of Defense (DOD) is illustrated graphically in Figure 1. The organizational structure is of particular importance in that it influences the priority DMDC places on certain jobs.

DEPARTMENT OF DEFENSE

Secretary of Defense

Deputy
Secretary of Defense

Office
Secretary of Defense

Under Secretaries
and
Assistant
Secretaries of Defense

Defense Agencies

Defense Logistics
Agency (DLA)

DEFENSE MANPOWER
DATA CENTER
(DMDC)
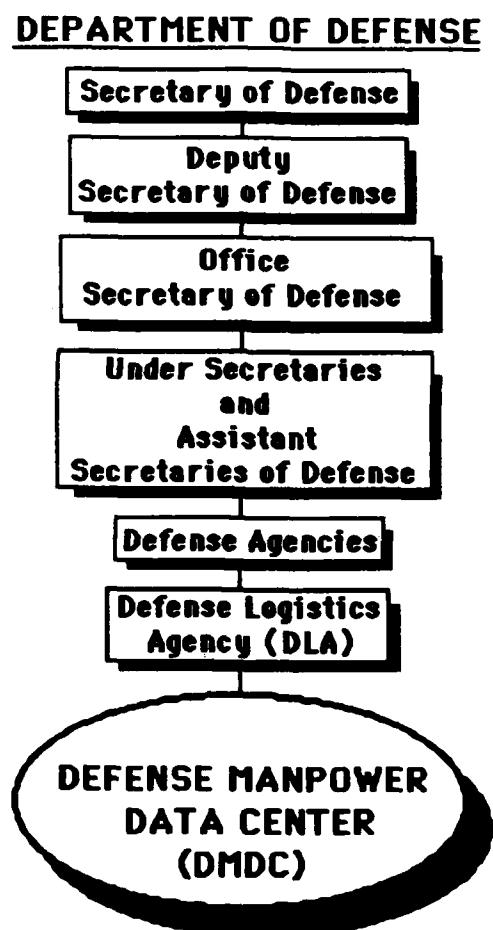
Figure 1. DMDC's Position Within DOD

DMDC's internal organizational structure, shown in Figure 2, is designed to permit as much organizational flexibility as possible. As with most organizations, the organizational chart does not explicitly indicate all lines of responsibility and internal communication, but merely serves as a guideline for broad functions.

DEFENSE MANPOWER DATA CENTER

OFFICE OF THE DIRECTOR

DOD ACTUARY

RESERVE AFFAIRS SPECIAL ASSISTANT CIVILIAN POLICY ANALYSIS SPECIAL ASSISTANT

SURVEYS AND MARKET ANALYSIS DIVISION

BRANCHES:
RECRUIT MARKET NETWORK
PERSONNEL SURVEY
MARKET RESEARCH

DATA BASE MAINTENANCE & PROGRAMMING DIVISION

BRANCHES:
DATABASE MANAGEMENT
PROGRAMMING AND SYSTEMS ANALYSIS
REPORTS
DEFENSE ENROLLMENT
ELLIGIBILITY REPORTING
MANPOWER DATA INFORMATION

INFORMATION OPERATIONS AND CONTROL DIVISION

Figure 2. DMDC's Internal Organizational Structure

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B. FUNCTIONS/RESPONSIBILITIES

DMDC's missions are:

- To support information requirements of the Office of the Assistant Secretary of Defense (Force Management and Personnel) [OASD (FM&P)].

- To assist OASD (FM&P) in the conduct of studies, analysis and research on Department of Defense personnel — Military, Civilian, Reserve, and Retired.

- To serve as a central facility within DoD for collection and use of manpower and personnel data through:

    - Centralized data files to increase access and efficiency in meeting DoD reporting requirements.

    - Historical reporting of personnel statistics.

C. DMDC PAST AND PRESENT

In 1974 DMDC was called Manpower Research and Data Analysis Center (MARDAC) and was established as a DoD activity within the Navy. In 1976 the name changed to Defense Manpower Data Center (DMDC) and established as a field activity of OASD (Manpower and Research Analysis). DMDC's mission and resources were transferred to Defense Logistics Agency (DLA) in 1977.

Currently DMDC is responsible to the Assistant Secretary of Defense, reports to the Deputy Assistant Secretary of Defense (Resources Management and Support), and is administratively and fiscally attached to DLA. DMDC holds the most comprehensive repository of automated personnel data in the Department of Defense which includes some 3.8 billion records on approximately 80 million individuals. It is responsible for frequent and timely updates of virtually all DoD personnel records and maintenance of historical records on DoD personnel from the early 1970's to the present.

Its services include:

- Ad-hoc data requests
- Manpower research and analysis
- Sample survey design and implementation
- Actuarial support and analysis
- Operational personnel program management
- Market research
- Reduction of fraud and abuse
- Periodic reports

DMDC supports information needs for a variety of organizations. Within DoD it supplies information to the Office of the Secretary of Defense (FM&P), other OSD, military departments, and DoD contractors. Outside DoD it supports Congress, other government agencies, universities and the general public.

DMDC's data acquisition strategy has three dimensions. First is life cycle tracking by acquiring data from active duty members from all services through service records, service entrance exams, and loss and gain statistical reports. Information is also generated through preservice attitude tracking, preservice examination and testing, accessioning information, periodic reporting while in DoD, reporting of major personnel actions, detailed records on compensation, separation information, and post service information. Secondly, DMDC gathers data with respect to the total force within DoD including civilians, active duty, reserve, and retired personnel. Thirdly, data is collected and organized longitudinally over time with respect to different programs (e.g. Army, Navy, etc.).

DMDC headquarters is located in Rosslyn, Virginia with two more offices in Monterey, California which are a tenant command of Naval Postgraduate School (NPS). Its computer resources, as shown in Figure 3, include a large International Business Machines Corporation (IBM) mainframe at NPS (IBM 3033-AP,IBM 3033-S,14 cartridge tape drives, 10 gigabytes of hard disk capacity, and 12,000 tape reels), a personal computer network, a support processor at DMDC-East (IBM 4331, 2 gigabytes of hard disk capacity, 2 tape drives, and an IBM PC network), many high speed peripherals, and coast to coast telecommunications with two 9600 baud leased lines. Other resources include an extensive software library, ten years of experience with data base design and maintenance with modern, state of the art, equipment.

NPS COMPUTER

IBM 3033-AP
IBM 3033-S
18 TAPE DRIVES
10 GIGABYTES DISK
25K REELS OF TAPE

Two 9600 Baud Leased Lines

DMDC-WEST

IBM PC Network
RJE Station

DMDC-EAST

IBM 4331
2 GIGABYTES DISK
2 TAPE DRIVES
IBM PC NETWORK
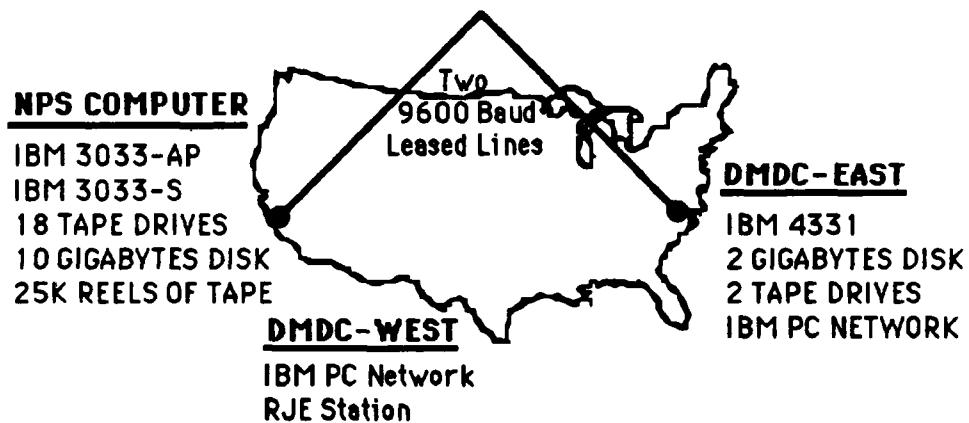
Figure 3. DMDC's Resources

The following is a list of DMDC's data files and coverage years:

	Coverage from:
• Active Duty	
— Inventory	June 71
— Loss Transactions	FY 71
— Service Gain Files	FY 76
— MEPCOM Examinations/Accessions	FY 71
• DoD Civilians	
— OPM Civilian Personnel Data File	FY 72
— DoD Civilian Personnel Data File	FY 78
— Civilian Transaction	FY 74
— Civilian Retirees	FY 72
• Reservists	
— Reserve Components Common Personnel Data System (RCCPDS)	June 74
— RCCPDS Gains and Losses	FY 78
• Military Retirees and Survivors	FY 73
• Dependents of DoD Military	
— Defense Enrollment Eligibility Reporting System (DEERS)	FY 83
• Military Veterans	
— DoD Post Service	FY 68
— VA Education and Training	Viet Nam Era
• DoD Survey Files	
— DoD Surveys of Officer and Enlisted Personnel	FY 72
— Surveys of Applicants and Recent Enlistees	FY 73
• DoD Joint Uniform Military Pay	FY 83
• DoD Joint Advertising Lead Files	
• Records of Deaths	FY 82
• Defense Central Index of Investigations	FY 83
• Service Advertising Placement Files	FY 85
• Unit Location/Address Files	FY 78
• VEAP Participation Files	FY 78
• High School ASVAB Test Records	FY 76
• Commercial/Industrial Activities	FY 77
• Military Training Files	FY 76

- Military Hospitalization Files   FY 78
- Attitude Survey Files   FY 79
- Census Files   FY 73
- Current Population Survey Files   FY 73
- Recruit Market Network Support Files   FY 77
- Federal Personnel Statistical Sample   FY 79
- Project 100 Thousand   FY 82
- U.S. Armed Forces Institute History File   FY 75

DMDC is not only heavily engaged in collecting and managing data, it is also active in data analysis. Some of the operational programs for which it provides analysis services are:

- DEERS
- DoD Inter-agency Debt Collection
- DoD Occupational Manual
- Reserve Components Common Personnel Data System
- DoD Survey Program Oversight
- Fraudulent Enlistment Detection System
- DoD/VA Reconciliation of Accounts
- Rent Plus Data Processing
- Variable Housing Allowance Survey
- DoD Civilian Manpower Mobilization Planning
- DoD Prior Service Reenlistment Eligibility System
- Centralized Matching Program for DoD Fraud and Abuse Reduction.

D. STAFF COMPOSITION/SKILLS

DMDC is authorized 92 civilian and 5 military positions. The military positions consist of an active duty officer from the Army, Air Force, Navy and two Reserve liaison officers. The staff is composed of a wide variety of professionals including actuaries, computer programmers, survey psychologists, statisticians, economists, systems analysts, and data base managers.

III. LASER OPTICAL DEVICES – THE BASICS

A. IN THE BEGINNING

Optical storage did not emerge operationally until early 1987, and those few optical disk units in operating environments were experimental. Users were attempting to connect them to their existing systems, programmers were developing interfaces and drivers for them, and developers and users were searching for applications that could take advantage of their massive storage capacities.

Since that time, optical storage has been making tremendous strides. Digital Equipment Corporation (DEC), International Business Machines, Inc. (IBM), and other large computer-based companies have announced optical disk units, giving legitimacy to the devices and creating user demand. Hardware and software interfaces that connect the units to standard systems have become available mostly through systems integrators, and erasable optical storage devices have been made available. [Ref. 2]

B. BASIC FACTS

Compact Disk-Read Only Memory (CD-ROM) and Write Once, Read Many (WORM) devices record data on a thin film by burning microscopic holes or pits in the film with a laser. A laser device reads the data by interpreting the presence or absence of holes.

Although a number of erasable optical media methodologies are under research and development, thermo-magneto-optical (TMO) seems to be the

frontrunner. An optically-assisted form of magnetic recording, this works by using an absorbed laser light to heat selected spots on the recording surface, reducing its ability to resist magnetism. A magnetic field then alters the magnetic domains on the disk, which is the method for writing and erasing. When the laser beam is removed, the heated area on the disk returns to normal temperature. The heat lowers the coercivity which is measured in Oersteds (Oe) and represents the media alloy's resistance to demagnetization. When it cools its coercivity returns to its normal high state. The recorded data is then stable and will be unaffected by any external magnetic fields.

On TMO media, reading the data requires interpreting a reflected laser beam. The magnetic orientation, or polarization, of the recorded data causes the beam to reflect off the magnetized bits differently. The reflected light goes to a photoconductor and analyzer for interpretation into binary data.

The coercivity of the erasable optical alloy at room temperature is in excess of 4000 Oe compared with a coercivity rating of 300-700 Oe for floppy disks and approximately 1000 Oe for Winchester hard disks. When the temperature of the thermo-magneto-optic recording layer rises to about 200 degrees Celsius, its high coercivity is temporarily lowered, and a weak magnetic field can then reverse the direction of magnetization.

Optical devices record and retrieve video, audio and image data as well as text data. These forms of information can be integrated and saved together and presented simultaneously, sometimes referred to as a multimedia presentation.

The recording capability of optical devices is of such extremely high-density, it enables one 5 1/4-inch optical disk to store an amount of data equal to

that contained on approximately 1,000 magnetic floppy disks. Some 12-inch optical platters can hold in excess of 2.6 gigabytes (GB) of information, which is the amount that can be stored on seven eight-inch hard disks or 60 2,400-foot magnetic tapes. [Ref. 3]

Optical media is almost indestructible compared with magnetic disks and tapes. Since data is stored without using magnetic polarization, optical disks can be mailed without special precautions and taken through X-ray machines and airport scanning devices without fear of data loss. Optically stored data is virtually unaffected by the environment or magnetic fields. Some manufacturers claim their optical media lasts for more than 30 years before data degradation, while magnetic tape media has an average life expectancy of only three to five years. "Although accelerated life testing is an acceptable procedure, a standard certification for media life has yet to emerge for optical disk formats." [Ref. 4] Only time will tell if vendors claims for media life will stand up. Then again, with the pace of the advancing technology, these particular devices may not be around long enough to exercise the media's guaranteed endurance.

Because optical disks are removable, data can be securely stored on or off-site. Also, the disks don't stretch with use as do magnetic tapes. Most optical media can't be altered, and optical media is less expensive per megabyte (MB) of storage than most magnetic tape, paper, or microform. [Ref. 5] Performance problems still exist, but these will probably be alleviated as the product proliferates in its target markets of data distribution, publishing, imaging, and database backup and archiving.

C. THE THREE BASIC OPTICAL STORAGE TYPES

There are three basic types of optical disks: Compact Disk-Read Only Memory (CD-ROM), Write Once, Read Many (WORM), and erasable units and media. The three types of optical disks do not compete against one another since each has its own unique properties and specific application niches. In addition to the three basic types, special application types such as Compact Disc Interactive (CD-I), capable of carrying still photographs and motion video as well as audio; and Compact Disk Video (CD-V), used for motion pictures, are also being advanced. [Ref. 6]

1. CD-ROM

CD-ROM optical disks originate through a process of mastering prerecorded data. It is a read-only system; therefore information can't be written on a CD-ROM disk by an end-user. CD-ROM is used primarily to distribute common non-frequently updated databases to multiple divisions, departments, or branch offices. The advantage of CD-ROM is that the data is protected against tampering or accidental erasing and can be used for archiving purposes.

Most systems of this type store around 600 MB of data on a 4.7-inch (12 centimeter) CD-ROM disk. Half-height 5 1/4-inch drives which store around 800 MB are also available. Most CD-ROM manufacturers have embraced the High Sierra Group and the ISO 9600 standards for file organization. Even though the 4.7-inch drive and media have become the industry standard [Ref. 7], manufacturers and developers are hoping it remains the standard.

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CD-ROM is the most economical optical media for mass distribution of large databases. [Ref. 5] A single CD-ROM can store the equivalent of 270,000 pages of text — which would typically weigh more than 2,800 pounds, occupy more than 110 feet of shelf space, and take more than 20 days to transmit at 2,400 bits per second. [Ref 8] The cost of preparing a master disk is relatively expensive, but the cost per copy can be as low as $2 in a large-scale distribution, making wide distribution of large databases (such as a large city telephone books) cheaper with CD-ROM than with paper.

a. Application Support Products

The CD-ROM market is alive with a variety of new and "announced" products to augment users in premastering their proprietary CD-ROM applications. Two influential products in the CD-ROM industry are CD Publisher, a low-cost product development tool and CD Master, both from Meridian Data, Inc. They enable the user to format data for CD-ROM mastering. They are PC-based systems which handle each step of CD-ROM data preparation including file structuring, content organization and simulation. The customer uses this product to prepare a tape which he then sends to a mastering facility for production. This eliminates the high cost of premastering for organizations with multiple CD-ROM applications.

Below is a list of other vendors and their respective authoring or premastering systems.

- **Advanced Graphic Applications Inc.**
  - *DISCUS 1000/2001*
- **Crowninshield Software Inc.**
  - *MediaBase/CD-ROM Formatter*
- **Dataware Inc.**
  - *CD AUTHOR*

- **Optical Media International Inc.**
  - *deskTOPiX*
  - *macTOPiX*
  - *TOPiX CD-ROM Premastering / Encoding System*
  - *TOPiX Software*
- **OWL International Inc.**
  - *Guide Library System*
- **Reference Technology Inc.**
  - *CD-Simulator Level 1 Software*
  - *CD-Simulator Level 2 Software*

In 1988, Meridian Data introduced CD Net and CD Server. These products enable one or more CD-ROM products to be accessed over a Local Area Network (LAN). They are compatible with Token Ring, Ethernet, and ARCNET, and support Novell and MS NET software.

CD Net is aimed at small- to medium-sized Local Area Networks (LAN's) for the purpose of sharing expensive drives to decrease the cost per CD-ROM user. CD Server is compatible with medium- to large-sized LAN's and other networking environments that require Winchester-like access to CD-ROM databases. [Ref. 9]

Microsoft also markets Microsoft Extensions, a software package that enables MS-DOS to overcome its 32-MB file size limitation and access the entire 600-MB capacity of CD-ROM. Microsoft Corporation provides the hardware-independent program, and Meridian Data provides the device drivers for major manufacturers' CD-ROM drive lines. [Ref. 10]

b. *CD-ROM Applications*

Microsoft's first CD-ROM offering, Bookshelf, consists of 10 reference databases for writers, including a thesaurus, world almanac, style guide, dictionary and familiar quotations. One Source, a financial database

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designed for money managers, portfolio managers and investment analysts, is produced by Lotus Development Corporation and updated each week. Bibliofile, the first CD-ROM application published, provides bibliographic information for libraries and book stores. It is produced by Library Corporation.

PC-Sig, a distributor of public domain software, now markets a CD-ROM containing more than 9,000 software programs. A series of business and financial disks from Disclosure Inc., a pioneer in the CD-ROM industry, provides detailed profiles of more than 11,000 companies traded on the New York and American stock exchanges, NASDAQ and over-the-counter.

The largest on-line company, Dialog Information Services, produces a number of CD-ROM products aimed at researchers, students, planners and librarians in academic and business environments.

c. CD-ROM Drives

Since standards for CD-ROM have been established, many companies have entered the market with drives in hopes of cashing in on what appears to be a long term (relative to the industry) profit-maker. Table 1 lists several companies vying for a market share in CD-ROMs.

Apple, Hitachi, Fujitsu, and Ricoh along with others, have joined in with full production commitments since format standards for CD-ROM make it appear to be a solid market. More companies will get involved as more applications are developed and the numbers of users increase as well.

2. WORM

WORM optical storage devices permit one-time *physical* writing but unlimited reading of data. Although previously stored data cannot be overwritten or erased, it can appear to be updated by writing new information

TABLE 1. CD-ROM DRIVE DISTRIBUTORS

Control Data 8100 34th Avenue Minneapolis, MN 55440	Decision Data Computer Corporation 400 Horsham Road Horsham, PA 19044
Hitachi America, OAS 950 Elm Avenue San Bruno, CA 94066	Laser Magnetic Storage 4425 Arrows West Drive Colorado Springs, CO 80907
Magnetic Media/3M Building 225-35-05 St. Paul, MN 55144	MDB Systems 1110 West Taft Avenue Orange, CA 92613
Pick Systems 1691 Browning Irvine, CA 92714	Reference Technology, Inc. 5700 Flatiron Parkway Boulder, CO 80301
System Technology Associates 15111 Mintz Lane Houston, TX 77014	Tandy Corporation 1800 One Tandy Center Fort Worth, TX 76102

into a file at another *physical* location on the disk. The new file is then linked to the original file with pointers and is retrieved in its correct place. This accomplishes a "virtual rewrite" which is transparent to the user. WORM media is generally available in 5 1/4-,8-, 12-, and 14-inch disks.

Because each track on WORM disks can only be written to one time, WORM is appropriate for handling data that must be updated or changed by a relatively small percentage over time. For example, a personnel master file that contains performance rating information can be updated with each annual rating and maintain past ratings for archiving, referral or analysis purposes.

In addition, WORM devices are being used by banks for payment and other customer documents, by insurance firms for policies and customer claim files, at medical facilities for patient records and diagnostic images, and in manufacturing facilities for engineering drawings and vendor or customer records. Copies of original documents retrieved from WORM media have also been determined to be legally admissible in the courts in place of the original document since the media is not alterable. [Ref. 11]

This particular aspect allows some users to eliminate massive amounts of original paper documents sometimes required to be kept for several years. For those who changed from microform to optical for archiving, lower retrieval costs and higher success rates of finding archived documents have made optical an economical productivity tool.

Ideal applications for WORM are those that require permanent records or tamperproof audit trails. It is more economical than CD-ROM for publishing and distributing information when only a few copies are needed because a mastering process is not required.

The software problems associated with the write-once, read-many (WORM) technology include file locating and rewriting, file directory updating, storage capacities that exceed operating system addressing abilities, access methods and error handling. But most of these problems can be solved or minimized. [Ref. 12] Thus, WORM disks may well become the media of choice for long-term and archiving storage. Most organizations with paper-intensive environments will happily trade increased access times for large capacity, unattended backup capability and high-volume storage and retrieval of integrated data, text and images.

Attractive to many organizations handling massive amounts of documents is WORM's ability to store images of the documents. These images can then be compressed by software that eliminates an image's blank space, thus providing for much greater storage efficiency. Administrative issues like indexing (which is required to randomly access archived images) is a major problem. Many systems integration and software companies have developed their own proprietary systems for handling indexing. [Ref. 5]

If prices continue to decrease, WORM media will probably replace magnetic tape for long-term archiving storage of critical data and possibly even for system backup. Its long life expectancy eliminates post-storage processing, required at least every five to six years when magnetic tape is used for data archiving.

Recent introduction of more accurate input scanners to convert printed images into digital data will probably cause sales of WORM drives to accelerate. Image scanning workstations using WORM optical devices for storage could fill the need to reduce many organizations' massive stores of documents and facilitate their quick and reliable retrieval. [Ref. 4]

a. WORM Drives

Table 2 lists several companies with WORM drives currently on the market as well as their respective product(s) disk size and capacity.

b. WORM Optical Disk Jukeboxes

Several systems integrators and original equipment manufacturers offer integrated systems and interfaces for a variety of computers. Table 3 lists several companies who sell jukebox systems.

TABLE 2. WORM DRIVE DISTRIBUTORS

Vendor	Disk Size (in)	Capacity (Mb)
Advanced Graphic Applications	5 1/4 /12	800/2000
Cherokee Data Systems	5 1/4	600
Hitachi America Ltd.	5 1/4 /12	600/2600
IBM Corp.	5 1/4	200
Laser Magnetic Storage	5 1/4 /12	654/2000
LaserData Inc.	5 1/4 /12	400/2000
Laserdrive Ltd.	5 1/4	810
Maximum Storage Inc.	5 1/4	760
Maxtor Corp.	5 1/4	786
Micro Design International Inc.	5 1/4	420
Mitsubishi Electronics America	5 1/4	600
N/Hance Systems Inc.	5 1/4	244
Optimem	12	4000
Pioneer Communications	5 1/4 /8	654/1500
Shugart Corp.	5 1/4	400
Storage Dimensions Inc.	5 1/4	786
Verbatim Corp.	3 1/2	60
Wang Laboratories Inc.	12	2000

TABLE 3. WORM JUKEBOX DISTRIBUTORS

Vendor	Disk Size (in)	Max. Disks
Aquidneck	12	141
Advanced Graphic Applications	5 1/4 /12	20/75
DataWare Inc.	12	141
FileNet Corp.	12	64-204
Mitsubishi Electronics America	5 1/4	152
Pioneer Communications	8	20
Verbatim Corp.	14	150
Wang Laboratories Inc.	12	89

3. Erasable Optical Storage

Sony, Hewlet-Packard (HP) and 3M jointly have stated their support for the Continuous Composite format standard for 130 mm rewritable media, based on magneto-optical technology. This format, originally defined for WORM disks, will ensure project compatibility and promote data interchangability among second-source vendors. As with most ad hoc standards, there are those who do not conform. Such is the case with Canon America, maker of the erasable drive incorporated in the NeXT computer, whose media does not conform to the standards for size, number of sectors, or encoding pattern agreed upon by other suppliers. Therefore, they are not interchangeable with other units. [Ref. 13]

Sony will continue to develop optical storage products for data storage applications using the proposed format standard and technology on personal workstations and multiuser computer systems. HP will develop products for archiving disk storage applications that will be integrated with the HP Precision Architecture family of business and technical computers. Both Sony and 3M are supplying magneto-optical media for these drives and systems.

a. Erasable Optical Drives

Although few of the erasable optical drives on the market today are able to interchange data due to different standards, companies appear eager to join the competition of this "leading edge" technology. Table 4 lists some of the companies currently offering erasable optical drives.

TABLE 4. ERASABLE OPTICAL DRIVE DISTRIBUTORS

Vendor	Disk Size (in)	Capacity (Mb)
Advanced Graphic Applications	5 1/4	650
Alphatronix Inc.	5 1/4	650
Canon USA Inc.	5 1/4	512
InSite Peripherals	3 1/2	20.8
Maxtor Corp.	5 1/4	650
Sony Corp. of America	5 1/4	650
Verbatim Corp.	3 1/2	60

D. OPTICAL DRIVES—WHICH ONE?

Critical in an organization's decision to use new technology is a complete understanding of business functions. In today's market, it is especially critical when considering optical technology. Once a drive is purchased, the media may then become fixed as far as format, capacity, capability, access speed and available sources.

If a CD-ROM drive is purchased and it is later discovered that WORM would have been a better choice for the application—too bad. If a WORM drive with 600 Mb capacity is purchased and the company announces 1200 Mb model a month later—the only way to upgrade may be to buy the new drive. An expensive erasable drive may be purchased, only to realize later that most of its application could have used WORM due to the relatively small amount of rewriting done and the need for a definite audit trail is heightened. It will become painfully obvious that a wrong system is installed.

The most dangerous situation could occur if there were only one company that supplied media for your particular drive—and that company goes out of business or decides not to support your brand of drive with media (at least not for the current price!). There have been cases like this where foreign suppliers were the sole source of media and it became unavailable due to U.S. government procurement restrictions. [Ref. 14]

It is especially noticeable in the WORM arena that different manufacturers market systems that are not compatible with any other manufacturer. It's comparable to being limited to buying one brand of cassette for a home audio tape system. A tape could be played on the home system but not on the owner's car system. Each manufacturer of drives would have to support all artists' music! Obviously, if WORM is to survive, standards must be set that will permit interchange of data and alternative media sources.

Archiving of data in this situation may also mean having a spare drive "archived" for insurance in the event the supplier goes out of business and leaves his WORM customers holding disks that no other vendor supports! The previous information on today's optical storage industry should give one appreciation for the many optical devices available and emphasize the need to do complete analysis not only of requirements prior to purchase but of optical device and media suppliers as well.

IV. QUERY FACSIMILE (QFAX)

A. WHAT IS QFAX?

QFAX is a collection of nine data bases maintained and managed by DMDC and supported by the services and DOD Civilian Personnel offices. It provides on-line access to personnel, retention, and pay data for all services active duty, reserve, and DOD civilian personnel. Although data for all services is available in QFAX, most of the accounts are set up to access only data from a certain service branch for which the user has a need to know.

The data is aggregated by DMDC staff prior to inclusion in QFAX, therefore, no Privacy Act information is at risk. QFAX's objective is to give users *immediate* access to information that formerly could only be obtained through a letter or telephone request. This process would sometimes take up to 30 days before the user could view the requested data. The on-line arrangement greatly augments user productivity over the formal request method. QFAX provides interactive multiple user accesses to a vast amount of DMDC's data thereby eliminating many data requests that would have to be prioritized and performed individually by a staff member of DMDC. Users need only type in a few simple commands to satisfy their original and any follow-up requests.

B. QFAX'S DATA BASES AND THEIR DESCRIPTION

Sample screens and reports of the following data bases are located in Appendix A.

1. Enlisted Retention Data Base

The Enlisted Retention Data Base is a time series covering 12 years of serial data for active duty enlistees (all services), with cross sectional details on any combination of up to ten population attributes.

2. Enlisted Management Data Base

This data base covers almost ten years of annual data. It provides formatted data on the enlisted inventory by rate, occupation area, and length of service, with additional information on advancements, gains, and losses. The data presently covers FY 80 through Fy 88. An older version of this data base with less detail is also available for years FY 76 through FY 79. All the data is updated annually, is fully operational, and is complete.

3. Joint Uniform Military Pay System (JUMPS)

This is one of two diagnostic data bases within QFAX. Its primary use is to validate and test the JUMPS compensation data currently under evaluation by DMDC. While the JUMPS data on QFAX is still tentative, it can be useful to "ballpark" or furnish estimates for both greatly detailed or highly aggregated inquiries. This data base can eventually achieve a high standard of reliability and once the JUMPS data input increases in reliability, the data base has been designed to specifically help in the process of identifying and correcting JUMPS data.

The pay data from JUMPS represents actual expenditures. QFAX currently provides four or more years worth of pay data reported for the last month of each FY on an annual basis. Both monthly aggregates and per capita pay data can be selected. About twenty pay components have been extracted or aggregated from the JUMPS payroll data. Corresponding

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population counts from the DMDC files are also provided. The data base will eventually store ten years of such data.

The main use of this data base involves matching social security numbers (SSNs) contained in the JUMPS data against SSNs contained in the DMDC active duty files. This allows the user to access pay and population components for any combination of eight different demographic components involving both officers and enlisteds, namely: Service, Pay Grade, Race, Sex, Marital Status, Number of Dependents, Years of Service, and Time in Grade. Whether monthly compensation is reported as aggregate totals or as a per capita rate is an option.

4. Defense Civilian Reporting System

This time series data base provides seven DMDC and OSD-generated reports on DOD civilian employees, with cross-section detail across approximately thirty population attributes such as pay plan, occupation, and pay grade. Data is reported quarterly within the current FY and contains annual detail for earlier dates, which, in some cases, may extend as far back as 1974. Current data availability is complete.

5. Officer Retention Data Base

This time series data base contains eleven years of summary including the five most recent quarters of serial data for officers on active duty, with cross-section detail on any combination of up to eleven different population attributes.

6. Officer Management Data Base

Ten years of annual data are stored serially in this data base. It provides formatted data on the officer inventory by grade, occupation area,

and length of service, with additional information on promotions, gains, and losses. The data, presently covering FY 80 through FY 88, is updated annually and is fully operational and complete.

7. Reserve Forces Automated Access System

The Reserve Forces Automated Access System includes twelve different reports covering summary of strength, gains, and losses, with partitions for such attributes as pay category, US state of origin, Armed Forces Qualification Test (AFQT) scores and education. Data is reported for every fiscal year, going back to FY 80 and includes the most recently reported month. Future expansion of the system calls for additional partitions similar to the Enlisted & Officer Management data bases.

8. Accessions Data Base

The Accessions Data Base contains data on non-prior service enlistment contracts and accessions for recent FYs, with subsequent quarterly updates for the last FY. These are broken down by service, education, sex, race, and AFQT score.

9. Permanent Change of Station Data Base

This, like the JUMPS data base is a diagnostic data base contained in QFAX. It contains several years of spreadsheet data on Permanent Change of Station (PCS) relocations for active duty officers and enlistees. Two major types of data are available: 1) costs of move, per pound broken down by service, pay grade, type of move, and marital status; 2) tour length, with partitions for service, pay grade, marital and dependent status, and budget category. While present data input is not highly reliable, but in future years the data should have much greater reliability and will be more complete.

C. QFAX OPERATION

Since the user/analyst accesses the data directly, there are no delays and no need to go through third parties. The user can quickly scan more data in much greater time-depth or cross-sectional detail. Since a wider data horizon is presented, this replaces the need for analysts to rely upon memory to piece data together. It also means there is less chance of analysis being "blind-sided" by additional data which otherwise would be difficult or time-consuming to access.

The user is able to specify his data requests from menu panels which can pinpoint data requests. All user specifications are self-documenting, on-line, and supported by an on-line HELP facility. The HELP facility instructs users whom to contact at DMDC to report any possible questions or irregularities. DMDC also maintains a QFAX bulletin board within the QFAX HELP facility.

QFAX supports access through 3270 terminals, PCs, modems, and TTYs. There is also an 800 WATTS line allowing easy access to users outside the Washington, D.C, area. Users may download data to a PC, download into Lotus 1-2-3, remotely print, or display data to the screen. Although a baud rate of 2400 can be used for data transfer, due to transmission quality, 1200 is more reliable for data transfer. DMDC makes the following communication software available at no charge to the user:

- SIMPC – a communications program with full-screen display capability.

- PC-TALK III – communications programs simulating Teletype (TTY) access.

- FORMAT-1-2-3 – reformats QFAX data to make it Lotus compatible.

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The QFAX system has two basic formats for presenting data to the user: spreadsheet (i.e., cross-section) and serial (i.e., time series). Note the word "basic". It is needed because the actual data on QFAX may exhibit both properties. For example, even though the Reserve Forces Automated Access System is "basically" in a spreadsheet format, it also has time depth, going back annually approximately five years. Conversely, another part of QFAX, the Enlisted Retention Data Base, is "basically" serial. However, it is easily downloaded into Lotus 1-2-3 and looks exactly like any spreadsheet would.

One difference in time series data will be readily apparent to the end-user. With spreadsheet data, QFAX always uses a record length of 132 bytes. The record length for time-series data can be larger than 132 bytes. Should the user opt to print out time series data without executing the EXEDIT commands[1] required to reformat the printout, everything over the 132 byte limit will be lost. The user must enter reformatting commands using EXEDIT to print out time series data and prevent losing everything over the 132 byte limit.

D. PHYSICAL FILE SIZES

Currently, QFAX is not entirely on-line. If a request requiring a massive search is made from any time series data base, a message advises the user that if the information is really needed, it will be available the next day. This is because the data requested cannot fit on the hard disk space allotted to the QFAX system. If the user responds in the affirmative, the job is batched and

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[1] EXEDIT=IBM supported mainframe word processing program.

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the operator will have to load tapes for the system to extract the requested data from the tape files. The data is then placed on the hard disk(s) allocated to QFAX for availability the next day. Table 5 is a summary of the data space currently occupied on magnetic hard disk by each data base.

TABLE 5. MEMORY STORAGE USED BY QFAX DATABASES

Data Base	Size (Mb)
Enlisted Retention Data Base	8.075
Enlisted Management Data Base	158.175
Defense Civilian Reporting System	67.830
Joint Uniform Military Pay System (JUMPS)	8.028
Officer Management Data Base	131.100
Officer Retention Data Base	0.760
Reserve Forces Automated Access System	2.470
Accessions Data Base	0.530
Permanent Change of Station Data Base	0.780
	377.748

E. THE AGGREGATION PROCESS

DMDC does not receive data files in aggregate form, but rather in the form of raw personnel data containing "Privacy Act" information. The processing required to obtain the aggregate data that appears on QFAX is extremely precise. The data sources for each QFAX data base varies, depending on the sponsoring agency, as does as their frequency of submission. The Reserve Forces Automated Access System, for example, is supported with monthly and quarterly master and transaction files from the reserve

programs for the Army, Navy, Air Force, and Marine Corps and the national guard programs for the Army, Air Force and Marine Corps.

Files are compared with their accompanying documentation (as to the number of records on each tape, etc.) to ensure each tape submitted is the correct one. Master and transaction tapes are then edited for correct format and validity through an automated editing program. Social security numbers (SSN's) are verified as to format and checked for duplicates. A new master is then created from the submitted master and transaction file for each service. The new master is then processed by a report processing program that generates aggregate data for inclusion into the QFAX data base. Raw data for the other QFAX data bases are processed in a similar manner.

F. QFAX USERS

The most frequent QFAX users other than DMDC staff consist primarily of Defense Logistics Agency (DLA) offices who use the data primarily for analysis to assist determining such things as proper force mix, recruiting goals, compensation levels, and identification of bonus recipients. In addition, data contained in QFAX is used to estimate the impact of proposed changes within DoD (e.g., a major reduction in force, a pay raise, or recruiting policy changes). Most users are located in the Washington, D.C. area and consequently receive many ad hoc data requests from congressmen, senators, executive staff members, and other government agencies.

Users interviewed were extremely pleased with the data QFAX provides them and the ease with which they can access the needed data. All stated they would like access to all the data for immediate viewing, but the one day waiting time for approximately 5% of their requests from the on-line data is

certainly acceptable. They were uniformly concerned with the speed of opera-
tion (1200/2400 baud through DMDC East), but, again, this is much faster
than they would receive the information with no on-line system.

Most users stated that 60–70% of their data requests could be obtained
through the menu selections currently available on QFAX and that the
remaining 30–40% were primarily non-recurring type requests that could not
be anticipated for inclusion in the on-line system. The data requests not met
by the on-line system are met by a telephone or letter request to DMDC West.
If necessary, a FAX machine is available to transmit complicated written
requests for more urgently needed reports.

As previously mentioned, DMDC staff members use QFAX to fulfill data
requests from agencies who do not have on-line access privilege due to the low
frequency of reports needed from QFAX. DMDC does not actively "market"
QFAX to potential users, but the staff does monitor the frequency and type of
data requests received by DMDC and will offer access to QFAX to those who
could benefit from the data it contains. Staff members do, however, look at
the overall frequency and type of data requests received by DMDC to offer
access to QFAX to those who they think would benefit by having immediate
access. Figure 4 shows a comparison between the annual number of DMDC
and non-DMDC accesses from 1985 through 1988. Figure 5 depicts the aver-
age number of accesses per year for each user category.

Figures 4 and 5 are only a rough measurement of the use of the system
to either of the user types (DMDC and non-DMDC), but merely the number of
accesses to the system by each. Some of the accesses to the system by DMDC
users are for maintenance purposes, not to gather requested data, yet some
are for data gathering.
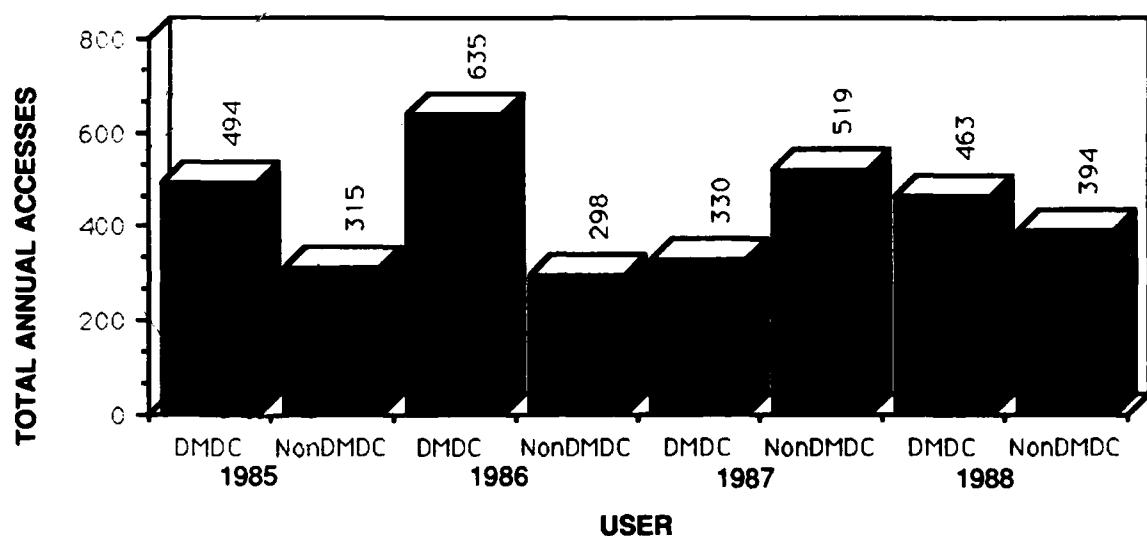
Figure 4. Total Annual QFAX Accesses '85–'88
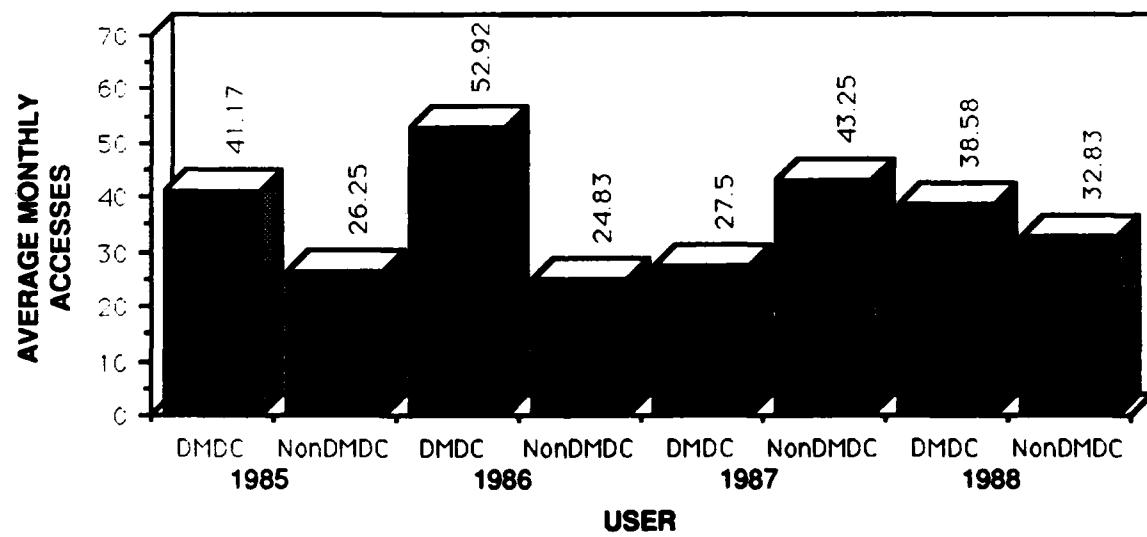
Figure 5. Average Annual QFAX Usage '85–'88

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V. QFAX: THE CURRENT SYSTEM

A. THE CURRENT SYSTEM CONFIGURATION AND ORGANIZATION [Ref. 15]

Mainframe computer resources for DMDC are supported by the Naval Postgraduate School (NPS), located in Monterey, CA. Local agreements have been worked out between the two organizations for management and use of the W.R. Church Computer Center located on the first floor of Ingersoll Hall on the NPS campus.

The Center's IBM 3033/4381 (IBM System/370 Series) computer network supports a great variety of programming facilities under several operating systems. The primary system is Virtual Machine/System Product (VM/SP) under which the Conversational Monitor System (CMS) provides interactive services. VM runs on a 2-cpu 3033AP system and is loosely coupled to a 2-cpu system (3033U/4381) running Multiple Virtual System/System Product (MVS/SP) with Job Entry Subsystem with networking (JES3).

Batch jobs are run under a priority scheduling system which gives the fastest turnaround to jobs with the least resource demands. Jobs may be prepared using the facilities of the CMS timesharing system and then submitted to MVS for batch processing. By using the Remote Spooling Communications Subsystem Networking (RSCS/NET), output may be returned to a CMS terminal, sent directly for printing, or placed on a disk which is shared by the two systems. Small MVS jobs are typically returned within a few minutes.

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Appendix B is a list of the major programming languages, application packages, and program libraries.

The VMS/CMS operating system supports general-purpose timesharing at local and remote terminals of different types (hardcopy terminals, video display units, graphical devices) available to users. DMDC is linked to the computer center by a mixture of remote terminals IBM and IBM compatible PC's which are remotely attached via modem.

Figure 6 shows the staff organization of the computer center. Most staff members have at least three years experience working with IBM hardware and software. They provide significant support to DMDC and the Naval Postgraduate School as well.

The computer center operates many different types and models of storage devices, most made and supported by International Business Machines (IBM). Appendix B lists computer center hardware as well as diagrams for the IBM 3033/4831 Central Processing Units (CPUs) network architecture. Appendix B also lists the major software available on the mainframe.

B. THE CURRENT SYSTEM PROCESS

In analyzing QFAX, it is helpful to understand the system hardware and its relationship to QFAX's operation. Reference to architecture diagrams in Appendix B will aid in understanding the "big picture" as a typical session with the system is eplained.

Figure 7 illustrates an example access assuming a user is located on the East coast (e.g., the Pentagon). The user dials a local number, 696-4345, through a 1200 or 2400 baud modem connected to an IBM or compatible PC. A connection is made to a multiplexer at DMDC-East and further by
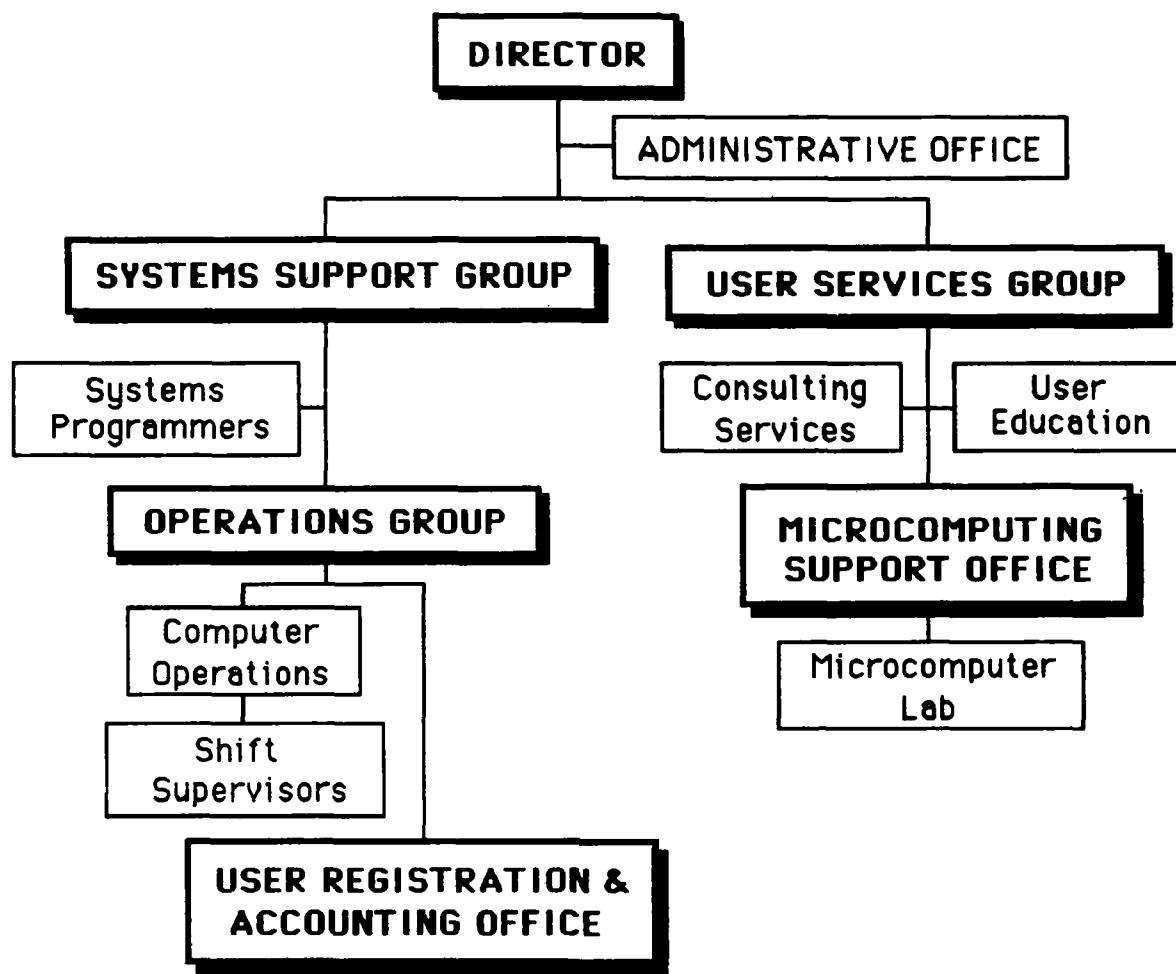
Figure 6. W. R. Church Computer Center Staff Organization
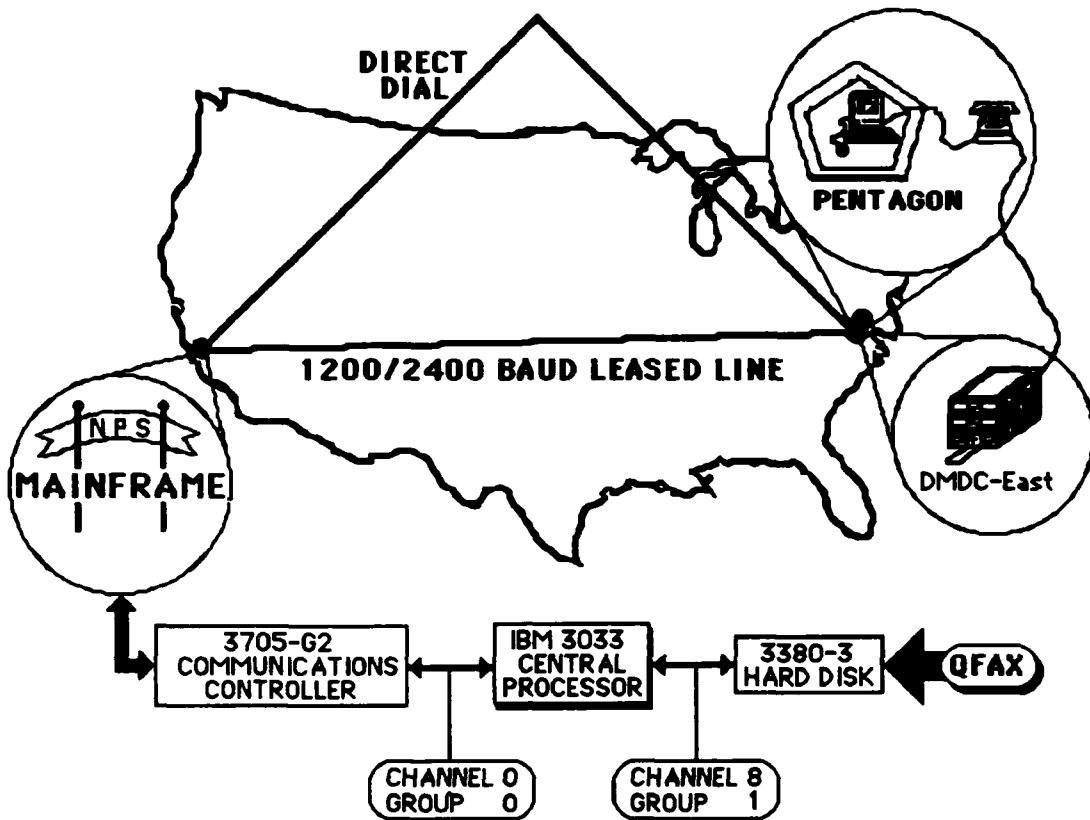
Figure 7. Tracing the QFAX System

dedicated leased-line to the NPS mainframe computer. This connection gives the user access to the 3033 central processor via the 3705-G2 communication control unit.

If normal login to the system is successful the user types "QFAX". Prior to executing the QFAX program, a command file is executed which calls the main QFAX program. The QFAX program, which is stored on one of the 33X0 disks, is brought into the NPS processor's main memory and execution initiates display of the main menu on the user's screen.

The program produces reports one of two possible ways. A report whose data is contained on the hard drive which is displayed, or a report whose data must be retrieved from one or several tape cartridges. In the latter case, a message prompts the user, "Your report will be in your file tomorrow. Do you still want the report?" The user can respond "no" and attempt to get the needed information by narrowing search parameters and retrieving the data in the form of two or more reports, or respond "yes" and wait until the next day for results.

Currently the computer uses the VM/CMS operating system. If the "next day report" is requested, the QFAX program submits the job of data extraction from tape cartridges to the batch processing system running under the MVS operating system via the 3088 Multi-System Channel Communication Unit of channel 4 of channel group zero.

Once the job is submitted to the batch system, the operating system sends a prompt to the operator to mount the proper tape cartridge in the drive. Each cartridge drive has two indicator windows, one displaying the index number of the mounted tape and the other displaying the index number of the tape the system is requesting. If the number is a system requested number, it flashes to call the operator's attention to it. This same request for a tape mount is also shown on the mainframe system status console display screen. The QFAX program includes the storage location (user account) for the batch processed report after completion. The user can access the requested information from his account immediately after completion.

The amount of time to complete the job depends on the size of the job, the number of resources required (usually only the 8480-A22 tape controller

and a cartridge tape drive), the system load, and the number of higher priority jobs in the batch system queue. Normally, one day is sufficient time to process any QFAX request.

Once the on-line requested report is generated, it can be saved to temporary or permanent disk space allocated to the user's account, erased, or printed on the mainframe's printer resources. The latter choice is obviously not practical if the user is in the Pentagon. Saving a report to temporary disk space uses one of the four drum storage units (IBM 2305-2) and is erased when the user quits QFAX . Permanent storage allows the user to name the report and save it in the disk space allocated to his account (usually 4200 Kbytes).

QFAX prompts the user to choose what to do with the generated reports at the end of each session. The reports can be downloaded as a QFAX file, converted to a Lotus-compatible format prior to downloading, printed locally (using SIMPC), saved to file, or erased.

Central to the thesis is the basic question of whether the use of optical storage improves the QFAX system enough to make it worthwhile. The first step in selecting an optical medium is to select the correct type: CD-ROM, WORM, or erasable optical. Since the data stored on the QFAX system is primarily static, it would seem that erasable is not needed. Since QFAX data is not widely distributed, CD-ROM is not a likely choice either. WORM technology offers unique benefits for application with QFAX such as:

- High-density (2+ gigabytes/disk) provides convenient, cost-effective (compared with direct storage access devices [DASD]), on-line storage of large databases

- Permanent, stable media is ideal for long life archival applications up to 30 years

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- Tamper-proof media

- Removable media is practical for automated storage and retrieval and provides for secure transportability

- Small system footprint/on-line capacity (ft^2/megabyte) produces significant space savings

- An error rate of less than one bit in 1012 ensures high reliability of recorded data

QFAX system characteristics suggest the best support is with WORM, but finding the correct one opens a myriad of possibilities. Future plans for upgrades to the computer center hardware will also play a part in selecting the proper WORM subsystem.

The procurement process has already begun to acquire an upgrade to the IBM 3033 CPU because of a 16 MByte main memory limitation. The plans for upgrade include purchase of an IBM 3090 or compatible CPU which would provide 256 MBytes of main memory. The new CPU will also involve a new operating system as well as revised or new versions of current application programs. This change will also be beneficial in that it will require less floor space in the computer center.

In addition to the mainframe upgrades, NPS will acquire a "super mini-computer" that will be located in the same area as the mainframe. The mini-computer will be networked to the mainframe. The for the minicomputer is to reduce the number of high CPU usage type ("number crunching") programs on the mainframe. This will probably fill up the space made available by the new CPU.

The staff of the NPS Computer Center must always be concerned with floor space. Any new equipment must always be evaluated for footprint size as well as space required for maintenance access as important considerations.

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VI. WORM SYSTEM ALTERNATIVES

In selecting a WORM system, the interface between the currently con-
figured IBM mainframe with its associated operating systems and an optical
device or system of devices is of primary importance. Most of today's optical
storage systems are developed and marketed by systems integration compa-
nies rather than original manufacturers of optical or computer equipment.
They develop custom and generic solutions to specific user applications. The
value they add is in combining and building interfaces for hardware and soft-
ware systems to meet market needs. Following is a description of several pos-
sible alternatives for implementing QFAX on WORM. Since DMDC's future
expansion tends to point to massive data storage, subsystems using drives
smaller than 12-inch were not considered.

A. DATA/WARE DEVELOPMENT, INC. [Ref. 16]

Data/Ware Development, Inc. is a systems integrator which has devel-
oped the DW34800 Optical Storage Subsystem (OSS) that appears to an
attached host processor to be a standard tape subsystem. The significant
difference of this arrangement is that all data on the OSS is on-line. Whereas
magnetic tapes have to be manually mounted into tape drives at request of
the operating system. In addition, on-line data can be accessed randomly as
well as sequentially, whereas tapes can only be accessed sequentially. Since
the OSS emulates the IBM 3480 tape drive, it can be conveniently used in
combination with both DASD and tape. The system supports a very large

volume of data, frequent use of the data, as well as the need for permanent storage in the case of QFAX.

1. DW34800 System Overview

The DW34800 Series Optical Storage Subsystem is a high performance optical mass storage and retrieval system. It provides a totally transparent interface between IBM System/370-compatible mainframes and multi-gigabyte optical media storage with high speed access to any volume. The technology of the system is based on12-inch WORM optical disk. Each disk has a capacity of 2 gigabytes, or 1 gigabyte on each of its two sides. It is available in a range of models including fully automated robotically-operated systems as well as manually-operated systems.

By emulating the IBM 3480 magnetic tape subsystem, and storing data as virtual tapes, the OSS system offers a practical solution to the need for access to gigabytes of data. The OSS A22 Control Unit emulates the IBM 3480-A22 unit and maps the functionality of the OSS B21 drives into that of the 3480-B22 dual drive. In addition, the OSS robotics and automated storage library provides the functionality of the operator of the IBM 3480 subsystem.

The typical OSS consists of an A22 Control Unit, two B21 Optical Disk Drives, one Automated Storage Library, and one D11 Operator's Console. The system is expandable to include up to sixteen B21 Optical Disk Drives, four Automated Storage Libraries, two D11Operator's Consoles, and two channel attachments with two static switches. The basic system is manually operated with one B21 Optical Disk Drive in a DW34800-P Basic Pedestal, providing 2 gigabytes of on on-line storage.

The OSS has the following features:

- An operator interface which provides the same functions of the IBM 3480 tape subsystem, providing important information to the operator in a standard format.

- A system of "virtual tapes" stored on optical disk media which are compatible with existing storage systems.

- A random access organization of data which takes advantage of the random access nature of disk media.

- A 12-inch optical disk enclosed in a protective cartridge for greater protection and automatic loading.

- Disk cartridge capacity of 2 gigabytes, an order of magnitude larger than IBM 3480 tape media.

- A microprocessor-controlled cache in the OSS A22 Control Unit to optimize data flow and throughput.

- An instantaneous data rate of 4.5 megabytes per second.

- Typical sustained data rate of 200 Kilobytes per second (record length dependent).

Furthermore, the system design is superior to alternative means of data storage in that the design permits:

- Reduced access time of data due to high capacity media and the incorporation of robotic loading methods.

- Reduced floor space requirements due to compact equipment size and high capacity media.

- Reduced operator labor due to automatic mounting and dismounting of virtual tapes.

- Reduced media storage space due to high-density optical disk storage.

The OSS subsystem can be attached to nonstreaming (block) multiplexer channels on *303X*, 3042 (attached Processor), 4341, *4381*, and 308X processors. It can also be attached to 2.0 megabytes per second streaming

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channels on the 4341 and *4381* processors. In addition, it can be attached to 3.0 megabyte streaming channels on the 303X (with the data streaming feature), the 3042 (with the data streaming feature), and the 4341, *4381*, and 308X processors. The subsystem is also compatible with the *3090* series and the 9370 family (when a multiplexer channel is available).

2. Media

The media capacity represents the equivalent of the maximum capacity of ten tape cartridges or 2400-foot reels of magnetic tape. In typical applications, tape cartridges and reels are very seldom fully utilized. Usually, the usage is 10 to 50 percent of a tape because of the time it takes to search a multiple file tape looking for the correct volume. One advantage of random by accessing virtual tapes on an optical disk is that the utilization factor on the disk is much greater than magnetic tape. Therefore, in a typical operating situation, one disk cartridge would be equivalent to over 100 tape cartridges or reels.

Each optical disk is housed in a protective cartridge. The cartridge provides for secure transportation of the media, either by operators or by the robotics of the automated storage library. The optical media is a disk constructed as a glass sandwich enclosing a tellurium alloy, which is the sensitive layer. The physical characteristics of this media are such that it is impervious to stray magnetic fields. The disk is pre-formatted and contains 32,000 tracks, each track containing 32 sectors of 1024 bytes of user data on each side of the disk.

Each disk cartridge includes a write-protect selector that, when set, prevents data from being written on the disk. Each disk cartridge can be

visually identified by a platter number label on the edge of the cartridge. The subsystem maintains the volume/serial number directory of all of the virtual tapes contained on a platter directly on that platter. Thus, each platter is completely self-contained. A platter may contain one or many virtual tapes on each of its sides. Virtual tapes can be rewritten or modified, and stored in another physical location on the platter. The directory for the platter is then updated to show the location of the new virtual tape.

Reliability of the optically stored data is assured by the use of Reed-Soloman Error Correction Codes (ECC). All data is written to the disk with ECC check symbols, which are used to detect and correct errors during both read and write operations. This results in an error rate of less than one bit in 10^{12}. The guaranteed archival life of the optically written disk is 30 years.

3. System Components

a. *Control Unit (A22)*

An OSS A22 Control Unit contains the logic for interpreting channel commands, controlling the data flow, and managing buffer operations. It includes an operator console (D11 video display terminal and keyboard) functions as the Operator Setup Panel on IBM 3480-A22 units. The Control Unit includes a buffer and cache which increase the effective data rate of the optical disk drives. The buffer and cache are partitioned among the optical disk drives under the management of the controller. A 68010 microprocessor manages the controller while another processor manages the channel attachment. Data is transferred between the buffer and the SCSI bus of the optical drives under the control of the 68010.

During read mode operations, the availability of the buffer and cache permits the Control Unit to give rapid response to host-read commands by pre-reading multiple records from the drives into the buffer. Similarly, during write mode operation, multiple records can be written from the host processor to the Control Unit buffer.

Random access seeks in response to tape motion commands are managed by the Control Unit mapping virtual tapes and updating with pointers. The Control Unit maintains a mapping structure of the virtual tape mounted in each drive in its local memory. The availability of this map permits the Control Unit to make random-access seeks on the optical disk in response to tape motion commands. This further enhances performance by eliminating sequential operations.

b. *Optical Drive (B21)*

The B21 Optical Drive, made by Laser Magnetic Systems (LMS), is a single spindle removable media optical disk drive. Two B21 units are the logical equivalent of the IBM 3480-B22 Tape Unit and Tape Drive (which is a dual transport). Each drive contains the mechanical elements necessary to load, spin, and access the media. A solid state laser diode provides the energy for reading and writing the optical disks. Electronic circuitry and a microprocessor controller read and write the media as commanded via the SCSI interface bus.

c. *Operator's Console (D11)*

The OSS D11 video display terminal and keyboard associated with the A22 Control Unit also provides the operator control panels for the B21 drives. The displays are identical to those with each of the two drives of a

B22 unit. The messages show drive status, error information, and other action information sent by either the drive or the attached host processor. OSS supports dual-D11 operator displays to enable operation of the unit from a second location. The operation of the simulated IBM A22 and B22 control panels is identical to the IBM units and minimizes operator training.

d. *Automated Storage Library (DW34800)*

The Automated Storage Library provides the functionality of the operator of the IBM 3480 subsystem. The robotics of the automated library manage the media and perform media mounts and dismounts. Mount messages sent by the attached host processor to the OSS are automatically interpreted and acted upon since each virtual tape has a volume/serial number according to IBM convention. If the requested virtual tape resides on the platter mounted in the drive, it will be mounted through the action of the A22 Control Unit. If the requested volume resides on another platter which is not currently mounted, the platter will be retrieved by robotics.

The Automated Storage Library employs high speed robotics. The efficient motion control can retrieve and mount any disk within ten seconds after receipt of the host-generated mount message. In a two drive configuration, a virtual tape can be mounting in one drive at the same time the robotics are replacing and retrieving a disk for the second drive. The automated library can hold up to 95 optical disks per drive (89 disks per drive in a two drive configuration), providing a storage capacity of 190 gigabytes (178 gigabytes with two drives). One to four drives can be installed in the Automated Storage Library and up to four automated libraries can be managed by one A22 Control Unit. Figure 8 illustrates the largest configuration with one control unit for a total storage capacity of 600 Gb and 16 drives.

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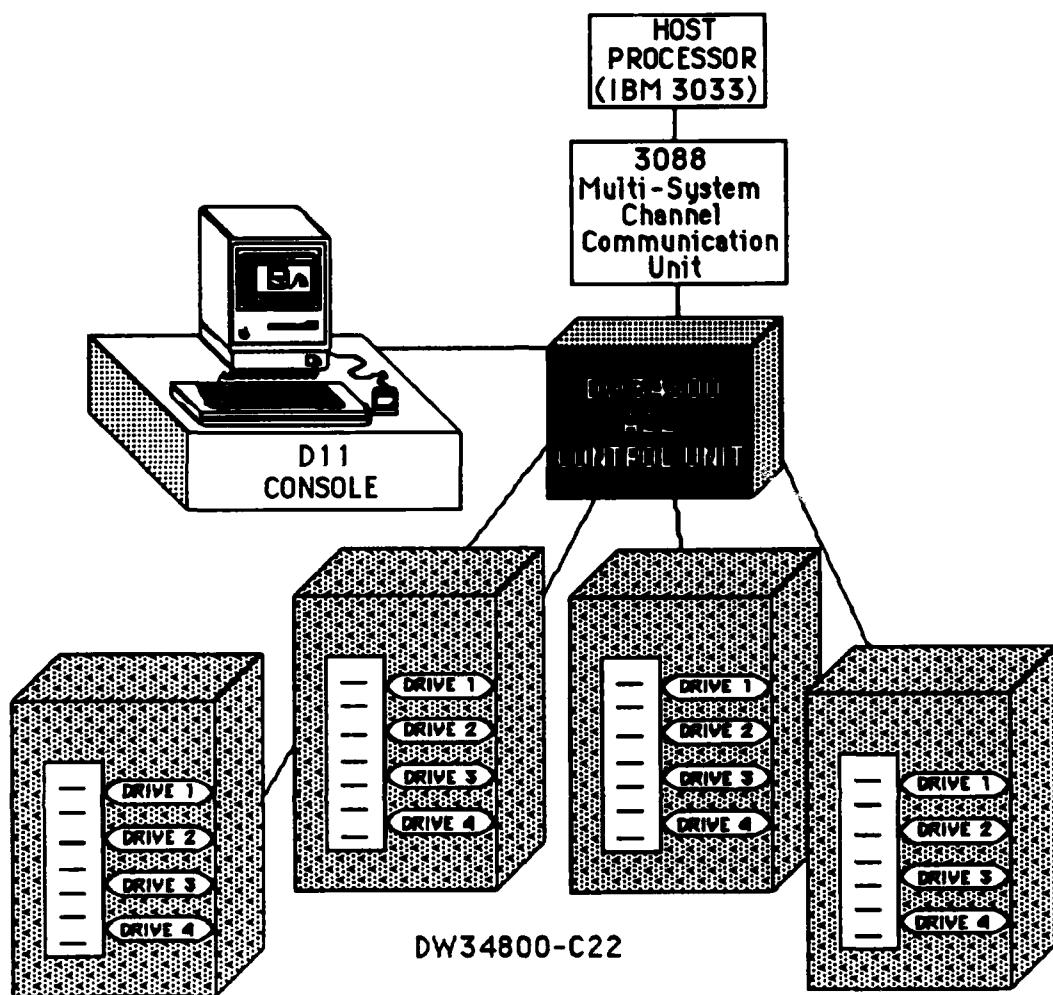
Figure 8. The Largest DW34800 Configuration

B. FILETEK, INC. [Ref. 17]

FileTek, Inc. is another system integrator offering WORM mass storage subsystems. The product most applicable to QFAX data is called the Storage Machine (SM). Software functionality for the SM includes:

- File access by full file, random record and key index.

- Automatic file migration to slower access locations in the archive based on frequency-of-use algorithms.

- File version management and file duplexing.

- File retirement and volume expiration.

- Export/Import

- User access security.

1. The Storage Machine Overview

FileTek's SM is an optical disk based mass storage computer system which incorporates off-the-shelf hardware, including optical disk library devices, with proprietary storage management software. [Ref. 20] Its design supports production mainframe environments to supplement and complement existing DASD.

Figure 9 illustrates the SM's architecture which enables a variety of mainframe host connections via a local area network (LAN). It can be configured to meet specific customer needs. Standard model systems include single or multiple processors and library devices, with storage capacities ranging from gigabytes to several terabytes. User interface software resides in host systems and standard terminals are used for retrieval and viewing of information.
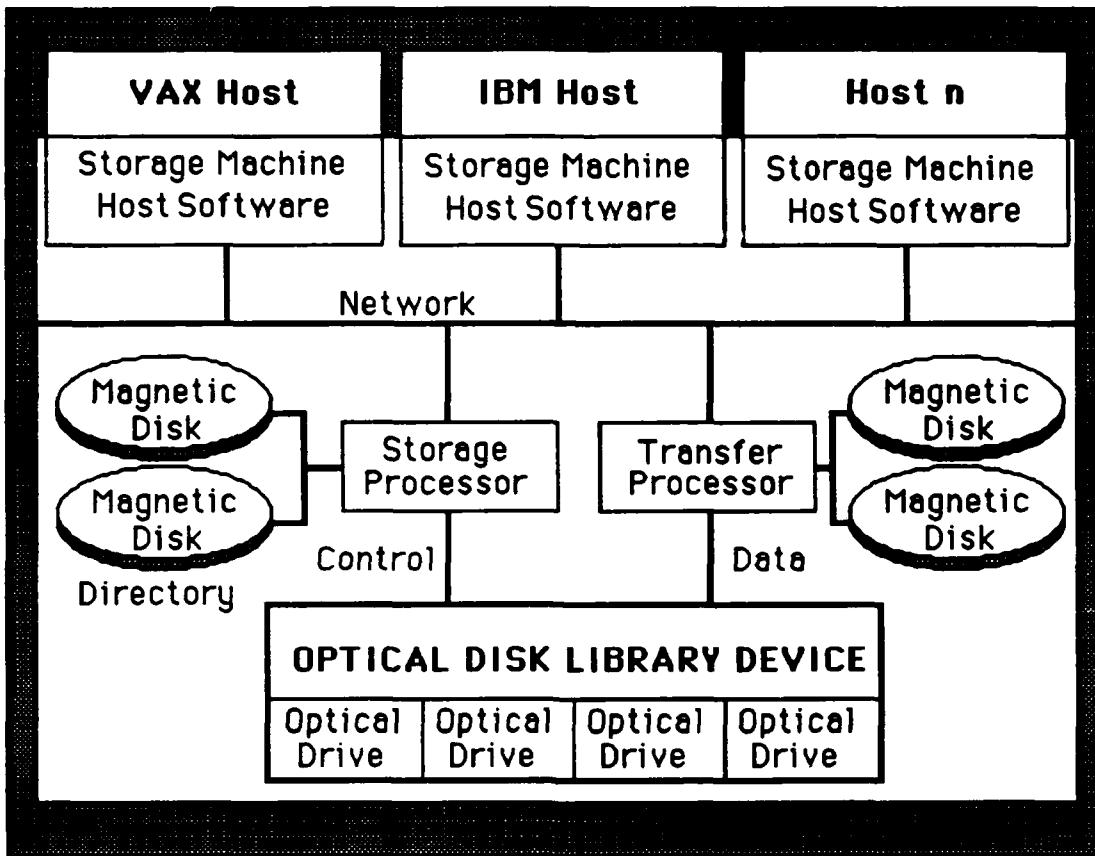
Figure 9. FILETEK's "Storage Machine System Architecture"

2. System Components

a. *Optical Drives*

Specifications for the Hitachi high performance 12-inch drives

are:

- Drive   Model OD 301A-1
- Controller   Model OF 301S-1
- Media Capacity   1.3 Gbyte per side (two sided)
- Average seek time   200 milliseconds (ms)
- Average Latency   50 ms
- Transfer Rate   0.44 Mbytes per second

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- Seat and Spinup Time — 4.5 seconds
- Spindown Time — 3.5 seconds
- Interface — SCSI
- Drive and Controller Weight — 68 lbs.
- Media Weight — 2.63 lbs.
- Hardware Interface — RS-232-C at 9600 baud
  25-PinSubminiature D connector
- Software Interface — Serial ASCII

b. *Media*

Media for the SM is capable of storing 1.3 Gbytes per side of each two sided optical disk. It has the same characteristics as does the media for the Dw34800 System. The media for the Hitachi drive is guaranteed for 30 years.

c. *Magnetic Disks*

Magnetic disks contain system directory information and user data. They can be used as a staging area for recently or frequently used files or as a cache. Standard configurations use two 554 megabyte Fujitsu magnetic disks for each processor. This storage area may be expanded based on system application requirements.

d. *Network Interface*

The use of a local area network provides support for many different host environments, facilitates attachment to a large number of hosts and offers installation flexibility due to support of long cable lengths. The SM uses Network Systems Corporation HYPER channel and NETEX network software.

e. *Data Access*

With FileTek's Virtual Record Access Manager (VRAM) software, a single record may be appended, updated and deleted, and may be accessed serially, by record number within a file or by index value.

f. *Host Computer Access*

The three user interfaces available for the SM are command language, using interactive or batch programs for system manage.nent; disk file transfer, providing transfer of files between the SM and host disks; and callable, providing callable command and record access.

g. *System Management*

A large segment of SM system software was developed to provide functionality in the areas of security, data integrity and recovery. There are multiple optional levels of security to protect from unauthorized access and users can take advantage of exits provided with host software, thereby extending host security systems.

In addition to Error Correction Codes provided with system hardware components, FileTek provides a software layer Error Detection Code to assure end-to-end data security from the host to the SM. Administrative and hardware logs are maintained to gather performance, accounting, and error logging/reporting.

In the event of failure of the primary directory, the directory can be recovered normally from the shadowed copy on another magnetic disk. The system can also rebuild directories from Volume Table of Contents (VTOC) on each optical disk.

The SM also maintains directory information for optical disk cartridges stored on shelves (off-line) outside the SM's optical disk library device. When access to an off-line optical disk is required, the system operator receives a message to load a specific disk and the user's retrieval request is completed.

C. IBM [Ref. 18]

Though most of the existing hardware is made by the IBM Corporation, IBM offers no optical storage equipment compatible with the current system. They have, however, announced plans for introducing an optical-based image processing application, the IBM ImagePlus™ Systems AS/400™. This system could be made to work for QFAX, but would involve installation of additional hardware not designed for applications such as QFAX. The announced system is also built around the IBM PS/2 MicroChannel microcomputer.

As can be seen in Figure 10, an additional modem would be required to link the AS/400 to the mainframe vice directly wiring the WORM drive as a peripheral to the mainframe. The AS/400 is the basic computer hardware for IBM's image processing system which is designed to be used primarily as a document image storage and retrieval workstation. To date, IBM offers no direct interface system for use between the NPS mainframe configuration and a 12-inch optical storage system.

Most system integrators take one of two approaches for interfacing as can be seen by the previous examples. One approach is to make the WORM subsystem emulate a tape drive. This eliminates operator retraining and makes implementation easy. The other approach is to interface the WORM subsystem via a LAN. This method permits future changes to the mainframe

as well as adding the capability of making the WORM subsystem accessible to multiple hosts.
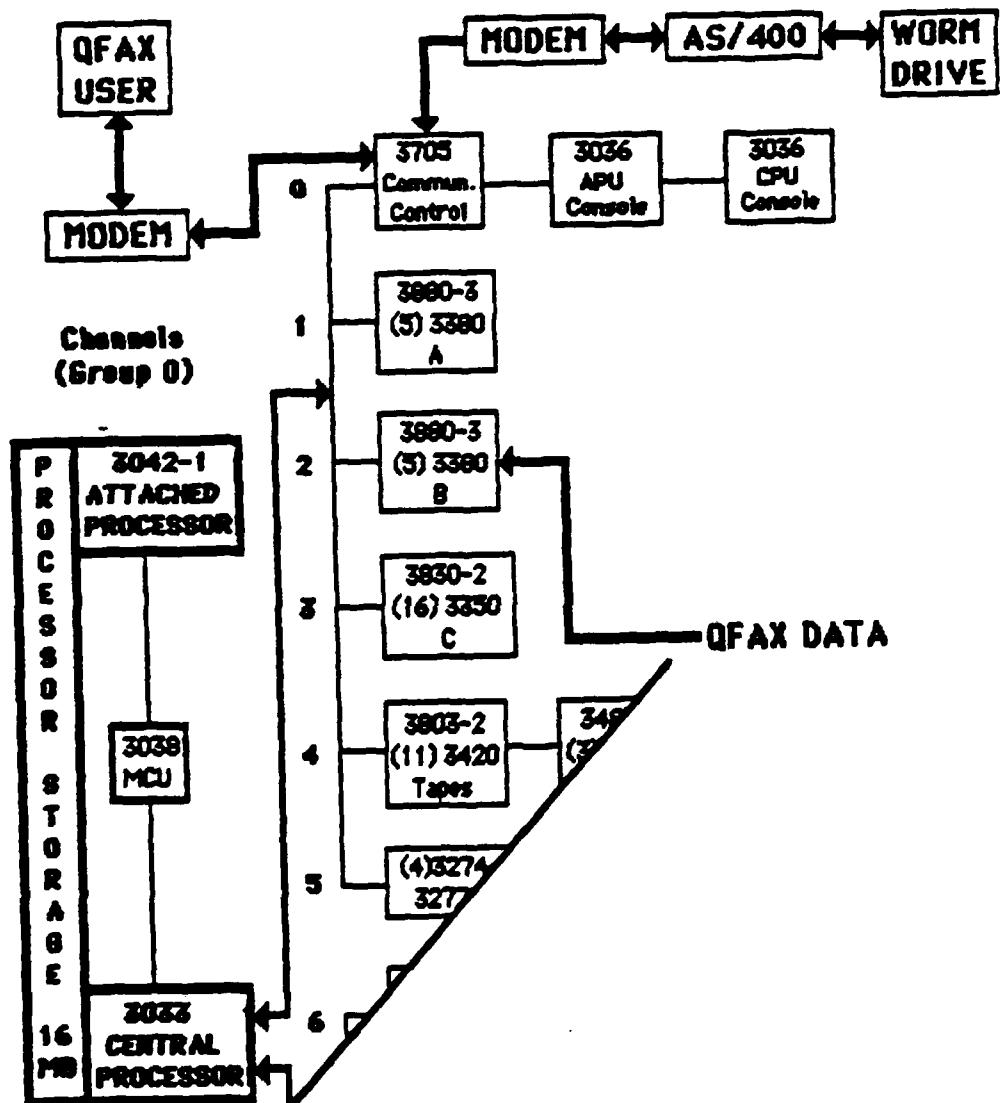
Figure 10. IBM's Image Plus Architecture

VII. SUMMARY

A. CONCLUSION

Although the use of WORM technology would expand the amount of information available to end users and free up space on scarce DASD resources, the impact of the change to WORM would be more harmful than helpful to QFAX users and DMDC staff. WORM performance is not yet fast enough to support interactive on-line systems whose users expect, as a minimum, the same response times they receive with a personal computer.

QFAX uses approximately 378 megabytes of hard disk (IBM 3380) space of the 45 GB of hard disk space available in the computer center (0.84%). Although any optimization of hard disk space is welcomed, removing QFAX from the hard disk and placing it on a WORM drive would have little impact in the broad sense of data storage savings to the NPS Computer Center.

Table 6 shows a comparison of performance between QFAX on the hard disk and approximately what it would be on two popular WORM drives.

TABLE 6. PERFORMANCE COMPARISON – WORM VS. HARD DISK

Parameters	IBM 3380 (Hard Disk)	LMSI	HITACHI
Avg. Seek Time (ms)	27.00	150	200
Avg. Latency (ms)	16.56	62.5	50
Transfer Rate (KB/Sec)	3000	262	440
Max. on-line Capacity (GB)	5.04	1	1.3
Retrieve 10 KB Report (Sec)	3.53	38.38	22.98

Since the maximum acceptable response time for interactive on-line systems in ten seconds [Ref. 22], it is apparent that a WORM system would be inadequate for QFAX or any other interactive on-line system by today's standards for required response time to users. In addition, a system this slow would discourage users from experimenting with the databases and discovering their maximum usage.

WORM technology offers tremendous storage capability by virtue of its compactness, ability to randomly access data at the record level, permanence and reliability of data and "near line" access capability. But, from Table 3, it is obvious that until the data transfer rate is increased by at least a factor of six, WORM is not a suitable method for storing on-line data for interactive use.

In the particular case of QFAX, users working via a 1200 baud modem who are already somewhat frustrated with response time would probably use the system less, even if more data were available to them on WORM. This would then cause an increase in DMDC staff workload and, hence, be more costly since users would revert to more, if not all, formal requests for reports.

Thirty (30) to 40 percent of the QFAX queries are ad-hoc and have no menus designed for them. If every conceivable query had a menu screen, the system would be too complex and cumbersome to use. In addition, it would require more staff to manage the system. Keeping in mind that QFAX is only one of many systems of data collection and management within DMDC, it would be managerially inappropriate to expend so much effort on QFAX alone.

It would be inappropriate for DMDC to implement QFAX on a WORM subsystem due to the reasons stated above. This does not mean that WORM technology could not be of significant benefit to DMDC in other areas.

B. RECOMMENDATION

Many organizations have been able to use WORM technology to increase their productivity in mass storage environments. WORM jukeboxes have enabled firms to have all their data stored on optical media as virtual tapes. This gives them much easier and faster access to data by eliminating the need for an operator to mount tapes or cartridges.

Through use of optical mass storage subsystems, the trend could change from that of the Central Processing Units (CPUs) as the center of large computer systems to the storage device as the center. Access for many interactive users on different hosts could be transparent as in modern network systems as depicted in Figure 11. [Ref. 20]

Even though WORM technology is new, it would be worthwhile to analyze other data system programs under DMDC's cognizance to identify candidate programs for WORM applications. Much of the data collected and managed by DMDC is permanent and, as such, would lend itself to WORM storage benefits. Tape cartridge and tape reel drives would still be required for transfer, receipt, processing and error checking data, but, once the data is in its final form, it could be placed on a WORM device for archiving: available for access within minutes versus days. Use of WORM would also eliminate the need for DMDC to replace magnetic tapes every five to six years due to media life characteristics.
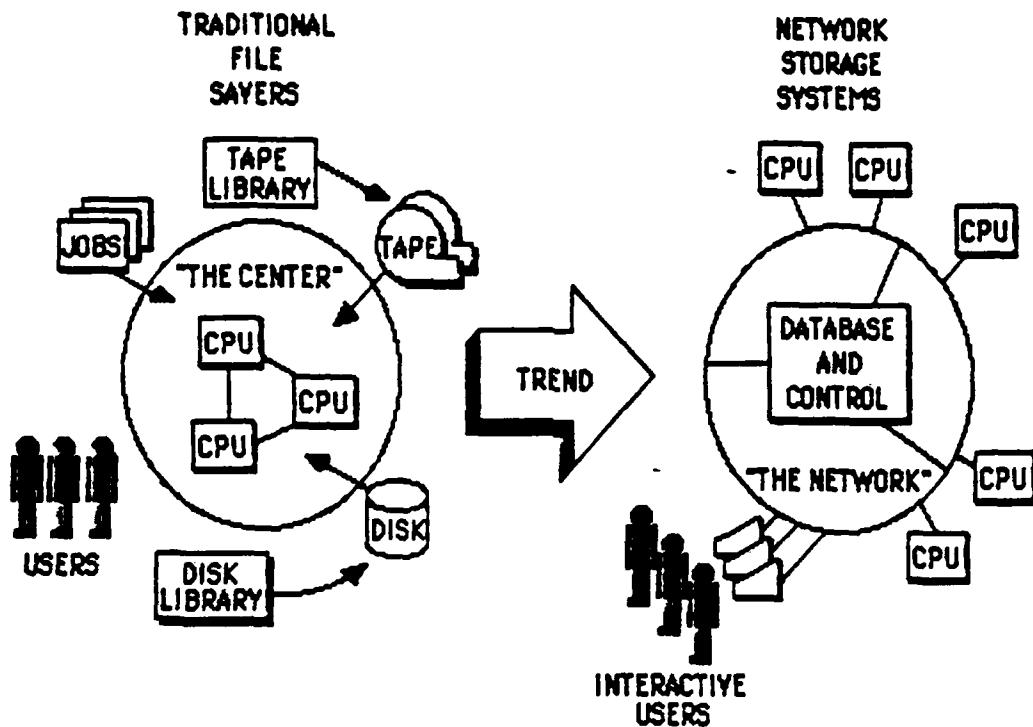
Figure 11. Possible Future Architecture Trend

An ideal application for WORM storage would be the annualized data, keeping the quarterly data on hard disk. This would allow time to fix problems with the quarterly data before it is included with the "permanent" data on a WORM device, thus making more efficient use of WORM storage media.

Only ad hoc industry standards exist for WORM optical devices and media, making transportability between organizations difficult. Lack of the ability to interchange disks with other organizations would have little impact on DMDC's operations since few organizations requesting or providing data would be likely to use 12-inch WORM to collect or transfer data.

An experimental one-drive WORM system that emulates an IBM 3480 tape cartridge drive could be installed for evaluation. Trials could be conducted with commonly used and shared files by placing duplicates on the WORM drive and judging comparative operations. Once appropriate files and methods of managing files on WORM were determined, the decision of whether to convert to WORM or continue with magnetic tape could be made.

APPENDIX A

SAMPLE QFAX MENU SCREEN AND REPORTS

The following pages show samples of screen menus available in QFAX. Some lower level menu screens, such as selection of sex, have been omitted since they would display the obvious detractors. A sample report or portion of a report is shown at the end of each database screen series. Below is an index for the location of screens for each database in QFAX.

Defense Manpower Data Center

QFAX

X	Enlisted Retention	-> FY88 now available
	Officer Retention	-> FY88 now available
	Enlisted Management	-> FY88 now available
	Officer Management	-> FY88 now available
	Reserves	
	Defense Civilians	
	Enlisted Management	-> Old Version
	Accession Database	
	Permanent Change of Station	-> Under Development
	Joint Uniform Military Pay System	
		-> FY88 now available

Use the Space Bar or Tab key to move the cursor to the desired topic,
then type any character and press the ENTER key.   Press PF3 to quit.

RETENTION DATA BASE

Primary Selection Menu

X   Pay Grade
     Primary Occupation Code (DPOC)
     Race
     Sex
     Education
     AFQT
     Service
     Years of Service
     Expiration of Term of Service (ETS)

To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.

| 1=HELP | 2=NEW SET | 3=QUIT | 4=GO | 5=FIRST PANEL | 6=LAST PANEL |
| 7=BACKWARD | 8=FORWARD | 9=SUMMARY | 10=MAIN | 11=SELECT ALL | 12=NEGATE ALL |

```
                    RETENTION   DATA   BASE

                    Primary Occupation Code (DPOC)
_____

              Total (Including Non-Occ)
         X    Electronic Repair
              Communications & Intelligence
              Medical & Dental
              Other Technical
              Functional & Administrative Support
              Electrical & Mechanical
              Craftsmen
              Service & Supply
              Combat Arms


To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections.  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP        2=NEW SET    3=QUIT      4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY   10=MAIN   11=SELECT ALL    12=NEGATE ALL
```

```
                    RETENTION   DATA   BASE

                           Education
_____




              Total
              Non High School Graduate
         X    High School Graduate






To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections.  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP        2=NEW SET    3=QUIT      4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY   10=MAIN   11=SELECT ALL    12=NEGATE ALL
```

63

```
RETENTION   DATA   BASE

                           AFQT
_____


                    X    Total
                         I & II
                         IIIA
                         IIIB
                         IV & V




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  enter to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP        2=NEW SET    3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY   10=MAIN   11=SELECT ALL   12=NEGATE ALL
```

```
RETENTION   DATA   BASE

                         Service
_____


                         Total
                         Army
                    X    Navy
                         Marine Corps
                         Air Force




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP        2=NEW SET    3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY   10=MAIN   11=SELECT ALL   12=NEGATE ALL
```

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```
┌─────────────────────────────────────────────────────────────┐
│ ═══════════════════════════════════════════════════════════ │
│                                                               │
│              R E T E N T I O N   D A T A   B A S E            │
│                                                               │
│                      Years of Service                         │
│ ───────────────────────────────────────────────────────────  │
│                                                               │
│                          Total                                │
│                                                               │
│    01    02    03    04     05    06    07    08    09    10   │
│    11    12    13    14  X  15    16    17    18    19    20   │
│    21    22    23    24     25    26    27    28    29    30   │
│    31+                                                         │
│                                                               │
│                                                               │
│  To make  your  selections  enter  any  character next  to  the desired  fields. │
│  When you have made your selections,  press  ENTER to continue,  or press one of │
│  the PF keys shown below for other functions. For more information,  press PF1.  │
│ ───────────────────────────────────────────────────────────  │
│  1=HELP       2=NEW SET    3=QUIT      4=GO     5=FIRST PANEL    6=LAST PANEL │
│  7=BACKWARD   8=FORWARD    9=SUMMARY   10=MAIN  11=SELECT ALL    12=NEGATE ALL │
│ ───────────────────────────────────────────────────────────  │
└─────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────┐
│ ═══════════════════════════════════════════════════════════ │
│                                                               │
│              R E T E N T I O N   D A T A   B A S E            │
│                                                               │
│       Months until Expiration of Term of Service (ETS)        │
│ ───────────────────────────────────────────────────────────  │
│                                                               │
│                          Total                                │
│                    X    Less than 13                          │
│                         13 - 24                               │
│                         25 - 36                               │
│                         37 - 48                               │
│                         49 - 60                               │
│                         Over 60                               │
│                                                               │
│                                                               │
│  To make  your  selections  enter  any  character next  to  the desired  fields. │
│  When you have made your selections,  press  ENTER to continue,  or press one of │
│  the PF keys shown below for other functions. For more information,  press PF1.  │
│ ───────────────────────────────────────────────────────────  │
│  1=HELP       2=NEW SET    3=QUIT      4=GO     5=FIRST PANEL    6=LAST PANEL │
│  7=BACKWARD   8=FORWARD    9=SUMMARY   10=MAIN  11=SELECT ALL    12=NEGATE ALL │
│ ───────────────────────────────────────────────────────────  │
└─────────────────────────────────────────────────────────────┘
```

Time Series

```
    8809         8806          8803          8712
    8709         FYE88    x    FY88     x    FY87
    FY86         FY85          FY84          FY83
    FY82         FY81          FY80          FY79
```

(Press PF1 or PF13 for information on what the dates represent)

To make your selections enter any character next to the desired fields. When you have made your selections, press ENTER to continue, or press one of the PF keys shown below for other functions.

1=HELP   11=SELECT ALL   12=NEGATE ALL

```
ACE:        SEX:      HYEC:    SERVICE:   BASE_CONT:   FY_87 FY_88
ON_WHITE    FEMALE    NON_HS   NAVY       BASE_YEAR#      40    91
ON_WHITE    FEMALE    NON_HS   NAVY       CONTINUED%    8000  8791
```

```
┌──────────────────────────────────────────────────────────────┐
│  ╔══════════════════════════════════════════════════════════╗ │
│  ║                                                          ║ │
│  ║          R E T E N T I O N   D A T A   B A S E            ║ │
│  ║                                                          ║ │
│  ║                      Time Series                         ║ │
│  ║──────────────────────────────────────────────────────────║ │
│  ║                                                          ║ │
│  ║                                                          ║ │
│  ║                                                          ║ │
│  ║      8809          8806          8803          8712      ║ │
│  ║      8709          FYE88    x    FY88    x     FY87      ║ │
│  ║      FY86          FY85          FY84          FY83      ║ │
│  ║      FY82          FY81          FY80          FY79      ║ │
│  ║                                                          ║ │
│  ║                                                          ║ │
│  ║   (Press PF1 or PF12 for information on what the dates    ║ │
│  ║                     represent)                           ║ │
│  ║                                                          ║ │
│  ║                                                          ║ │
│  ║ To make your selections enter any character next to the  ║ │
│  ║ desired fields. When you have made your selections,      ║ │
│  ║ press ENTER to continue, or press one of the PF keys     ║ │
│  ║ shown below for other functions.                         ║ │
│  ║──────────────────────────────────────────────────────────║ │
│  ║                                                          ║ │
│  ║        1=HELP     11=SELECT ALL    12=NEGATE ALL          ║ │
│  ╚══════════════════════════════════════════════════════════╝ │
└──────────────────────────────────────────────────────────────┘
```

```
┌──────────────────────────────────────────────────────────────┐
│                                                                │
│                                                                │
│                                                                │
│  ACE:       SEX:    HYEC:    SERVICE:  BASE_CONT:  FY_87 FY_88  │
│  ON_WHITE   FEMALE  NON_HS   NAVY      BASE_YEAR#    40    91   │
│  ON_WHITE   FEMALE  NON_HS   NAVY      CONTINUED%  8000  8791   │
│                                                                │
│                                                                │
└──────────────────────────────────────────────────────────────┘
```

```
D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                          G F A X

+-------------------------------------------------------------+
|   |   | Enlisted Retention        -> FY88 now available   |
| X |   | Officer Retention         -> FY88 now available   |
|-----------------------------------------------------------|
|   |   | Enlisted Management       -> FY88 now available   |
|   |   | Officer Management        -> FY88 now available   |
|-----------------------------------------------------------|
|   |   | Reserves                                          |
|   |   | Defense Civilians                                 |
|   |   | Enlisted Management       -> Old Version          |
|   |   | Accession Database                                |
|   |   | Permanent Change of Station  -> Under Development |
|-----------------------------------------------------------|
|   |   | Joint Uniform Military Pay System                 |
|   |   |                           -> FY88 now available   |
+-------------------------------------------------------------+

    Use the Space Bar or Tab key to move the cursor to the desired topic,
    then type any character and press the ENTER key.   Press PF3 to quit.
```

```
        O F F I C E R    R E T E N T I O N    D A T A    B A S E

                        Primary Selection Menu
-------------------------------------------------------------------
                    x    Pay Grade
                         Primary Occupation Code (DPOC)
                         Race
                         Sex
                         Education
                         Service Branch
                         Component
                         Years of Commissioned Service
                         Years of Service
                         Source of Entry

To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
-------------------------------------------------------------------
1=HELP        2=NEW SET     3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD    8=FORWARD     9=SUMMARY  10=MAIN   11=SELECT ALL   12=NEGATE ALL
-------------------------------------------------------------------
  FY-ENDING 88 DATA IS NOW AVAILABLE.  PRESS PF1 OR PF13 FOR CODING CHANGES!
```

```
┌─────────────────────────────────────────────────────────────┐
│ ══════════════════════════════════════════════════════════  │
│       O F F I C E R   R E T E N T I O N   D A T A   B A S E   │
│                                                               │
│                        Pay Grade                              │
│ ─────────────────────────────────────────────────────────── │
│                                                               │
│                 x    Total                                    │
│                      Warrant Officers                         │
│                      01                                       │
│                      02                                       │
│                      03                                       │
│                      04                                       │
│                      05                                       │
│                      06                                       │
│                      General Officers                         │
│                                                               │
│ To make  your  selections  enter  any  character next  to  the desired  fields. │
│ When you have made your selections,  press  ENTER to continue,  or press one of │
│ the PF keys shown below for other functions. For more information.  press PF1.  │
│ ─────────────────────────────────────────────────────────── │
│ 1=HELP       2=NEW SET    3=QUIT      4=GO     5=FIRST PANEL    6=LAST PANEL │
│ 7=BACKWARD   8=FORWARD    9=SUMMARY   10=MAIN  11=SELECT ALL    12=NEGATE ALL │
│ ══════════════════════════════════════════════════════════  │
└─────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────┐
│ ══════════════════════════════════════════════════════════  │
│       O F F I C E R   R E T E N T I O N   D A T A   B A S E   │
│                                                               │
│                 Primary Occupation Code (DPOC)                │
│ ─────────────────────────────────────────────────────────── │
│            x    Total (Including Non-Occ)                     │
│                 General Officers & Execs                      │
│                 Tactical Operations (except Pilots & Aircrew) │
│                 Intelligence                                  │
│                 Engineering & Maintenance                     │
│                 Scientists & Professionals                    │
│                 Medical (except Doctors & Dentists)           │
│                 Administrators                                │
│                 Supply, Procurement & Allieds                 │
│                 Pilots        Aircrew                         │
│                 Doctors       Dentists                        │
│ To make  your  selections  enter  any  character next  to  the desired  fields. │
│ When you have made your selections,  press  ENTER to continue,  or press one of │
│ the PF keys shown below for other functions. For more information,  press PF1.  │
│ ─────────────────────────────────────────────────────────── │
│ 1=HELP       2=NEW SET    3=QUIT      4=GO     5=FIRST PANEL    6=LAST PANEL │
│ 7=BACKWARD   8=FORWARD    9=SUMMARY   10=MAIN  11=SELECT ALL    12=NEGATE ALL │
│ ══════════════════════════════════════════════════════════  │
└─────────────────────────────────────────────────────────────┘
```

```
          O F F I C E R   R E T E N T I O N   D A T A   B A S E

                              Education
   _____


                         Total
                         Non College Graduate
                         College Graduate
                    x    Masters
                         PhD




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions. For more information,  press PF1.
   _____

1=HELP          2=NEW SET    3=QUIT       4=GO       5=FIRST PANEL    6=LAST PANEL
7=BACKWARD      8=FORWARD    9=SUMMARY    10=MAIN    11=SELECT ALL    12=NEGATE ALL
```

```
          O F F I C E R   R E T E N T I O N   D A T A   B A S E

                              Component
   _____


                         Total
                         Regular or Temporary
                    x    Reserve or National Guard




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions. For more information,  press PF1.
   _____

1=HELP          2=NEW SET    3=QUIT       4=GO       5=FIRST PANEL    6=LAST PANEL
7=BACKWARD      8=FORWARD    9=SUMMARY    10=MAIN    11=SELECT ALL    12=NEGATE ALL
```

```
          O F F I C E R   R E T E N T I O N   D A T A   B A S E

                     Years of Commissioned Service
─────────────────────────────────────────────────────────────────

                              Total
                              01 - 04
                              05 - 10
                          x   11 - 16
                              17 - 22
                              Over 22



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  enter to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
─────────────────────────────────────────────────────────────────

1=HELP        2=NEW SET    3=QUIT        4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY    10=MAIN    11=SELECT ALL    12=NEGATE ALL
```

```
          O F F I C E R   R E T E N T I O N   D A T A   B A S E

                           Years of Service
─────────────────────────────────────────────────────────────────



                              Total

    01      02      03      04      05      06      07      08      09      10
    11      12    x 13      14      15      16      17      18      19      20+



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
─────────────────────────────────────────────────────────────────

1=HELP        2=NEW SET    3=QUIT        4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=FORWARD    9=SUMMARY    10=MAIN    11=SELECT ALL    12=NEGATE ALL
```

```
┌──────────────────────────────────────────────────────────────┐
│  ──────────────────────────────────────────────────────────  │
│         O F F I C E R   R E T E N T I O N   D A T A   B A S E │
│                                                              │
│                     Source of Entry                          │
│  ──────────────────────────────────────────────────────────  │
│                                                              │
│                                                              │
│                    Total                                     │
│                    Academy                                   │
│                    ROTC                                      │
│                    OCS / OTS                                 │
│                    Direct Appointment                        │
│                 x  Aviation Trainee                          │
│                                                              │
│                                                              │
│  To make  your  selections  enter  any  character next  to  │
│  the desired  fields.                                        │
│  When you have made your selections,  press  ENTER to        │
│  continue,  or press one of                                  │
│  the PF keys shown below for other functions.  For more      │
│  information,  press PF1.                                     │
│  ──────────────────────────────────────────────────────────  │
│  1=HELP      2=NEW SET    3=QUIT      4=GO    5=FIRST PANEL   6=LAST PANEL │
│  7=BACKWARD  8=FORWARD    9=SUMMARY  10=MAIN  11=SELECT ALL  12=NEGATE ALL │
│  ──────────────────────────────────────────────────────────  │
└──────────────────────────────────────────────────────────────┘
```

AYGRADE:	SEX:	EDUCATION:	BASE_CONT:	FY_87	FY_88
3	FEMALE	MASTERS	BASE_YEAR#	4191	4534
3	FEMALE	MASTERS	CONTINUED%	9079	9096

72

```
           D e f e n s e     M a n p o w e r     D a t a     C e n t e r

                                  Q F A X

    +-----------------------------------------------------------------------+
    |   |   Enlisted Retention           ->  FY88 now available  |
    |   |   Officer Retention            ->  FY88 now available  |
    |---+-------------------------------------------------------------------|
    | X |   Enlisted Management          ->  FY88 now available  |
    |   |   Officer Management           ->  FY88 now available  |
    |---+-------------------------------------------------------------------|
    |   |   Reserves                                             |
    |   |   Defense Civilians                                    |
    |   |   Enlisted Management          -> Old Version          |
    |   |   Accession Database                                   |
    |   |   Permanent Change of Station  -> Under Development     |
    |   |   Champus Database             -> Under Development     |
    |---+-------------------------------------------------------------------|
    |   |   Joint Uniform Military Pay System   ->  FY88 now available  |
    +-----------------------------------------------------------------------+

    Use the Space Bar or Tab key to move the cursor to the desired topic,
    then type any character and press the ENTER key.   Press PF3 to quit.
```

```
    _____

            E N L I S T E D   M A N A G E M E N T   D A T A   B A S E

                               Fiscal Year
    _____


                          x   FY 88
                              FY 87
                              FY 86
                              FY 85
                              FY 84
                              FY 83
                              FY 82
                              FY 81
                              FY 80


    To make  your  selections  enter  any  character next  to  the desired  fields.
    When you have made your selections,  press  ENTER to continue,  or press one of
    the PF keys shown below for other functions.  For more information,  press PF1.
    _____

    1=HELP        2=N/A      3=QUIT        4=GO       5=FIRST PANEL    6=LAST PANEL
    7=BACKWARD    8=N/A      9=SUMMARY     10=N/A     11=SELECT ALL    12=NEGATE ALL
    _____
```

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│       E N L I S T E D   M A N A G E M E N T   D A T A   B A S E           │
│                                                                           │
│                          Occupation Areas                                 │
│   ─────────────────────────────────────────────────────────────────      │
│                                                                           │
│                                                                           │
│     Total                        Infantry, Gun Crew & Seamanship Specialists │
│     Electronic Equipment Repairmen  Communications and Intelligence Specialists │
│     Medical and Dental Specialists  Other Technical and Allied Specialists │
│   x Functional Support & Admin.   Electrical/Mechanical Equipment Repairmen │
│     Craftsmen                     Service and Supply Handlers              │
│     Non-Occupational                                                      │
│                                                                           │
│                                                                           │
│   To make  your  selections  enter  any  character next  to  the desired  fields. │
│   When you have made your selections,  press  ENTER to continue,  or press one of │
│   the PF keys shown below for other functions.  For more information,  press PF1. │
│   ─────────────────────────────────────────────────────────────────      │
│                                                                           │
│   1=HELP        2=N/A     3=QUIT       4=GO       5=FIRST PANEL    6=LAST PANEL │
│   7=BACKWARD    8=N/A     9=SUMMARY    10=N/A     11=SELECT ALL    12=NEGATE ALL │
│   ─────────────────────────────────────────────────────────────────      │
│   Press PF4 if you have entered all of your selections. For a summary press PF9. │
└─────────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│       E N L I S T E D   M A N A G E M E N T   D A T A   B A S E           │
│                                                                           │
│                             Race Ethnic                                   │
│   ─────────────────────────────────────────────────────────────────      │
│                                                                           │
│                                                                           │
│                             Total                                         │
│                             White                                         │
│                             Black                                         │
│                             Hispanic                                      │
│                           x Other                                         │
│                                                                           │
│                                                                           │
│   To make  your  selections  enter  any  character next  to  the desired  fields. │
│   When you have made your selections,  press  ENTER to continue,  or press one of │
│   the PF keys shown below for other functions.  For more information,  press PF1. │
│   ─────────────────────────────────────────────────────────────────      │
│                                                                           │
│   1=HELP        2=N/A     3=QUIT       4=GO       5=FIRST PANEL    6=LAST PANEL │
│   7=BACKWARD    8=N/A     9=SUMMARY    10=N/A     11=SELECT ALL    12=NEGATE ALL │
│   ─────────────────────────────────────────────────────────────────      │
│   Press PF4 if you have entered all of your selections. For a summary press PF9. │
└─────────────────────────────────────────────────────────────────────────┘
```

```
E N L I S T E D   M A N A G E M E N T   D A T A   B A S E

                            Report Type
_____


                        Inventory
                        Retention
                        Promotions
                  x     Gain
                        Loss




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP         2=N/A      3=QUIT       4=GO       5=FIRST PANEL    6=LAST PANEL
7=BACKWARD     8=N/A      9=SUMMARY    10=N/A     11=SELECT ALL    12=NEGATE ALL
_____
```

INTENTIONALLY LEFT BLANK

```
1 PART_4:_GAINS                                                    ___NAVY___              DATE_OF_RUN-01/09/89
  OCCUPATIONAL CATEGORY:                                                                   FOR-OASD_(FM&P)MM&PP_(O&EPM)
  ELECTRONIC_EQUIP._REPAIRERS            REPORT_OF_ENLISTED_PERSONNEL_ON_ACTIVE_DUTY        DMDC_REPORT-_85M8820
  SEX:_FEMALE                                       AS_OF_30_SEP_88
  RACE:_BLACK                               BY_YEAR_OF_SERVICE_AND_PAY_GRADE
  REPORT_NO:_222401
```

YR_OF_SVC GRADE:	E1	E2	E3	E4	E5	E6	E7	E8	E9	UNK	E1-E3	E4-E9	E1-E9	%DIS
1 YR	17	2	5	1	0	0	0	0	0	0	24	1	25	89.
2 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
3 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
4 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
5 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
6 YRS	0	0	0	1	0	0	0	0	0	0	0	1	1	3.
7 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
8 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
9 YRS	0	0	0	0	0	0	0	0	0	0	0	2	2	7.
10 YRS	0	0	0	0	0	2	0	0	0	0	0	0	0	0.
11 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
12 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
13 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
14 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
15 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
16 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
17 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
18 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
19 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
20 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
21 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
22 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
23 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
24 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
25 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
26 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
27 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
28 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
29 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
30 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
31+ YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
_1-4 YRS	17	2	5	1	0	0	0	0	0	0	24	1	25	89.
_5-10 YRS	0	0	0	1	0	2	0	0	0	0	0	3	3	10.
_11-20 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
_21-31 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
_5-31 YRS	0	0	0	1	0	2	0	0	0	0	0	3	3	10.
UNKNOWN YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
GRAND TOTAL	17	2	5	2	0	2	0	0	0	0	24	4	28	100.
% _1-4	100.00	100.00	100.00	50.00	.00	.00	.00	.00	.00	.00	100.00	25.00	89.29	
% _5-10	.00	.00	.00	50.00	.00	100.00	.00	.00	.00	.00	.00	75.00	10.71	
% _11-20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
% _21-31+	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
% _5-31+	.00	.00	.00	50.00	.00	100.00	.00	.00	.00	.00	.00	75.00	10.71	
NON-PRIOR SVC	17	2	5	1	0	0	0	0	0	0	24	1	25	
PRIOR SERVICE	0	0	0	1	0	2	0	0	0	0	0	3	3	
RESERVE GAINS	1	0	1	0	0	0	0	0	0	0	2	0	2	
TERM_OF_ENLSTMNT														
_2	0	0	0	0	0	2	0	0	0	0	0	2	2	
_3	0	0	0	1	0	0	0	0	0	0	0	1	1	
_4	16	2	4	1	0	0	0	0	0	0	22	1	23	
_5	0	0	0	0	0	0	0	0	0	0	0	0	0	
_6	0	0	0	0	0	0	0	0	0	0	0	0	0	
UNK	1	0	1	0	0	0	0	0	0	0	2	0	2	

^Z

```
         D e f e n s e     M a n p o w e r     D a t a     C e n t e r

                              Q F A X

|---+----------------------------------------+-------------------------|
|   |   Enlisted Retention                ->  FY88 now available  |
|   |   Officer Retention                 ->  FY88 now available  |
|---+----------------------------------------+-------------------------|
|   |   Enlisted Management               ->  FY88 now available  |
| x |   Officer Management                ->  FY88 now available  |
|---+----------------------------------------+-------------------------|
|   |   Reserves                                                  |
|   |   Defense Civilians                                         |
|   |   Enlisted Management               -> Old Version          |
|   |   Accession Database                                        |
|   |   Permanent Change of Station       -> Under Development    |
|   |   Champus Database                  -> Under Development    |
|---+----------------------------------------+-------------------------|
|   |   Joint Uniform Military Pay System -> FY88 now available   |
|---+----------------------------------------+-------------------------|


    Use the Space Bar or Tab key to move the cursor to the desired topic,
    then type any character and press the ENTER key.   Press PF3 to quit.
```

```
         O F F I C E R     M A N A G E M E N T     D A T A     B A S E

                              Fiscal Year

                         x   FY 88
                             FY 87
                             FY 86
                             FY 85
                             FY 84
                             FY 83
                             FY 82
                             FY 81
                             FY 80


To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.

1=HELP        2=N/A      3=QUIT      4=GO       5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=N/A      9=SUMMARY   10=N/A     11=SELECT ALL    12=NEGATE ALL
```

```
OFFICER   MANAGEMENT   DATA   BASE

                    Race Ethnic
_____



                         Total
                         White
                       x Black
                         Hispanic
                         Other




To  make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____
1=HELP        2=N/A      3=QUIT       4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=N/A      9=SUMMARY    10=N/A      11=SELECT ALL    12=NEGATE ALL
_____
```

```
OFFICER   MANAGEMENT   DATA   BASE

                    Report Type
_____



                         Inventory
                         Retention
                         Promotions
                       x Gain
                         Loss




To  make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue.  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____
1=HELP        2=N/A      3=QUIT       4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=N/A      9=SUMMARY    10=N/A      11=SELECT ALL    12=NEGATE ALL
_____
```

78

```
    O F F I C E R   M A N A G E M E N T   D A T A   B A S E

                            Service
_____



                          Army
                       x  Navy
                          Marine Corps
                          Air Force
                          DoD




To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP         2=N/A      3=QUIT      4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD     8=N/A      9=SUMMARY   10=N/A      11=SELECT ALL    12=NEGATE ALL
_____
```

```
    O F F I C E R   M A N A G E M E N T   D A T A   B A S E

                    Navy Competitive Categories
_____

   Total
 x Line Unrestricted                Judge Advocate General
   Chaplain Corps                   Medical Corps
   Dental Corps                     Medical Service
   Nurse Corps                      Supply Corps
   Civil Engineering Corps          Line Limited Duty Officer
   Supply Limited Duty Officer      Civil Engineering Limited Duty Off.
   Aero Engineering Duty (Aeronautical)   Aero Engineering Duty (Maintenance)
   Spec Duty Officer (Cryptology)   Spec Duty Officer (Intelligence)
   Spec Duty Officer (Public Affairs)   Spec Duty Officer (Oceanographics)


To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP         2=N/A      3=QUIT      4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD     8=N/A      9=SUMMARY   10=N/A      11=SELECT ALL    12=NEGATE ALL
_____
```

1 PART_5:_LOSSES

COMPETITIVE_CATEGORY:

_NURSE_CORPS

SEX:_FEMALE

RACE:_TOT

REPORT_NO:_225507

____NAVY____

REPORT_OF_OFFICER_PERSONNEL_ON_ACTIVE_DUTY

AS_OF_30_SEP_38

BY_YEAR_OF_SERVICE_AND_PAY_GRADE

DATE_OF_RUN-01/19/89

FOR-OASD_(FM&P)NM&PP_(O&EPM)

DMDC_REPORT-_0S40020

_YOS GRADE:	01	02	03	04	05	06	07	08	09	010	_01-06	_04-06	_07-010	_01-01
1 YR	1	0	0	0	0	0	0	0	0	0	1	0	0	
2 YRS	3	0	0	0	0	0	0	0	0	0	3	0	0	
3 YRS	4	3	0	0	0	0	0	0	0	0	7	0	0	
4 YRS	1	85	1	0	0	0	0	0	0	0	87	0	0	0
5 YRS	1	1	9	0	0	0	0	0	0	0	11	0	0	1
6 YRS	0	1	29	0	0	0	0	0	0	0	30	0	0	3
7 YRS	0	0	6	0	0	0	0	0	0	0	6	0	0	0
8 YRS	0	0	7	3	0	0	0	0	0	0	10	3	3	1
9 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
10 YRS	0	0	10	2	0	0	0	0	0	0	12	2	0	1
11 YRS	0	0	3	2	1	0	0	0	0	0	6	3	0	
12 YRS	0	0	6	3	0	0	0	0	0	0	9	3	0	
13 YRS	0	0	1	2	0	0	0	0	0	0	3	2	0	
14 YRS	0	0	0	5	0	0	0	0	0	0	5	5	0	
15 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
16 YRS	0	0	0	1	0	0	0	0	0	0	1	1	0	
17 YRS	0	0	0	1	0	0	0	0	0	0	1	1	0	
18 YRS	0	0	0	0	1	0	0	0	0	0	1	1	0	
19 YRS	0	0	0	0	1	0	0	0	0	0	1	1	0	
20 YRS	0	0	0	0	2	0	0	0	0	0	2	2	0	
21 YRS	0	0	0	4	13	0	0	0	0	0	17	17	0	1
22 YRS	0	0	0	1	5	0	0	0	0	0	6	6	0	
23 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 YRS	0	0	0	0	1	2	0	0	0	0	3	3	0	
25 YRS	0	0	0	0	1	1	0	0	0	0	2	2	0	
26 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
27 YRS	0	0	0	0	2	1	0	0	0	0	3	3	0	
28 YRS	0	0	0	0	0	1	0	0	0	0	1	1	0	
29 YRS	0	0	0	0	0	3	0	0	0	0	3	3	0	
30 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
31 YRS	0	0	0	0	0	1	0	0	0	0	1	1	0	
32 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
33 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
34 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
35 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
36 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
37 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
38 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
39 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
40 YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
41+ YRS	0	0	0	0	0	0	0	0	0	0	0	0	0	
_1-20 YRS	10	90	80	19	5	0	0	0	0	0	204	24	0	20
_1-5 YRS	10	89	10	0	0	0	0	0	0	0	109	0	0	10
_6-11 YRS	0	1	63	7	1	0	0	0	0	0	72	8	0	7
_12-20 YRS	0	0	7	12	4	0	0	0	0	0	23	16	0	2
_21-41 YRS	0	0	0	5	22	9	0	0	0	0	36	36	0	3
UNKNOWN YRS	0	1	5	10	2	0	0	0	0	0	18	12	0	1
GRAND TOTAL	10	91	85	34	29	9	0	0	0	0	258	72	0	23
NON-RETIREMENTS _	10	91	83	25	4	0	0	0	0	0	213	29	0	21
__VOL _	2	87	66	22	4	0	0	0	0	0	181	26	0	18
__INVOL _	8	4	17	3	0	0	0	0	0	0	32	3	0	3
RETIRE TOTAL	0	0	2	9	25	9	0	0	0	0	45	43	0	4
__>20 DIS	0	0	0	0	2	0	0	0	0	0	2	2	0	
__>20 NON-DIS	0	0	0	6	22	9	0	0	0	0	37	37	0	3
__<20 DIS	0	0	2	3	1	0	0	0	0	0	6	4	0	

```
              D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                                   Q F A X
        +-----+------------------------------------------------------------+
        |  |  |  Enlisted Retention              ->  FY88 now available  |
        |  |  |  Officer Retention               ->  FY88 now available  |
        |--+--+-----------------------------------------------------------|
        |  |  |  Enlisted Management             ->  FY88 now available  |
        |  |  |  Officer Management              ->  FY88 now available  |
        |--+--+-----------------------------------------------------------|
        | X|  |  Reserves                                                |
        |  |  |  Defense Civilians                                       |
        |  |  |  Enlisted Management             -> Old Version          |
        |  |  |  Accession Database                                      |
        |  |  |  Permanent Change of Station     -> Under Development     |
        |  |  |  Champus Database                -> Under Development     |
        |--+--+-----------------------------------------------------------|
        |  |  |  Joint Uniform Military Pay System -> FY88 now available |
        +-----+------------------------------------------------------------+

      Use the Space Bar or Tab key to move the cursor to the desired topic,
      then type any character and press the ENTER key.   Press PF? to quit.
```

```
 R E S E R V E   F O R C E S   A U T O M A T E D   A C C E S S   S Y S T E M

                                Fiscal Year
 _____

                                X  FY 88
                                   FY 87
                                   FY 86
                                   FY 85
                                   FY 84
                                   FY 83
                                   FY 82
                                   FY 81
                                   FY 80



To make  your  selections  enter  any  character next  to  the desired fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
 _____

  1=HELP  2=COMPONENTS  3=QUIT  4=GO  9=SUMMARY  11=SELECT ALL  12=NEGATE ALL
 _____

        To see definitions of Component Categories, press PF2 or PF16
```

81

```
╔═══════════════════════════════════════════════════════════════════════╗
║  R E S E R V E   F O R C E S   A U T O M A T E D   A C C E S S   S Y S T E M  ║
║                                                                           ║
║                              Report Type                                  ║
║───────────────────────────────────────────────────────────────────────────║
║          (A1) Summary Strength Report                                     ║
║          (A2) Strength by Training Pay Category                           ║
║       X  (A3) Strength by State                                           ║
║          (A4) Strength by Grade                                           ║
║          (A6) Strength by Race/Sex                                        ║
║          (G1) Summary of Gains by Month                                   ║
║          (G4) Profile of Gains by Race/Sex/Mental Group (Enlisted Only)   ║
║          (G7) Profile of Gains by Race/Sex/Education                      ║
║          (L1) Summary of Losses by Month                                  ║
║          (L2) Summary of Losses by Month, by Training Pay Category        ║
║          (L3) Profile of Losses by Transaction Code, by Grade             ║
║          (L4) Profile of Losses by Race/Sex/Mental Group (Enlisted Only)  ║
║          (L7) Profile of Losses by Race/Sex/Education                     ║
║When you have made your selections, press ENTER to continue, or press one of║
║the PF keys shown below for other functions. For more information, press PF1.║
║───────────────────────────────────────────────────────────────────────────║
║  1=HELP  2=COMPONENTS  3=QUIT  4=GO  9=SUMMARY  11=SELECT ALL  12=NEGATE ALL║
║───────────────────────────────────────────────────────────────────────────║
║Panel 2 of 2  (After making selections, press PF4 to ACCESS or PF9 for SUMMARY)║
╚═══════════════════════════════════════════════════════════════════════╝
```

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1DEPARTMENT_OF_DEFENSE
DEFENSE_MANPOWER — — — — — — — — — — STRENGTH_BY_STATE_(UNIT) — — — — — —
DATA_CENTER

— — — — — — SELECTED_RESERVE_STRENGTH

__AS_OF____SEPTEMBER_1988
__RUN__JANUARY____19,_1989
__REPORT_ A3   PAGE__01

STATE	OFFICERS							ENLISTED							_DOD _TOTAL	_EN&G _USCG
	__ARNG	__USAR	__USNR	__USMCR	__ANG	_USAFR	_TOTAL	__ARNG	__USAR	__USNR	__USMCR	__ANG	_USAFR	_TOTAL		
ALABAMA	2473	1637	229	39	353	173	4904	18859	6802	2014	789	2828	799	32091	36995	21
ALASKA	360	71	29	2	156	17	635	2870	252	100	51	884	83	4240	4875	6
ARIZONA	632	562	130	17	317	195	1853	4940	410	1285	410	2405	1331	12565	14416	9
ARKANSAS	1018	708	67	3	251	31	2078	9104	4355	685	185	1928	218	16473	18551	
CALIFORNIA	2285	4211	4548	436	719	2165	14362	18455	16679	16171	4756	5045	10276	71382	85744	165
COLORADO	526	914	389	28	227	293	2377	3231	2706	1680	414	1278	1331	10640	13017	6
CONNECTICUT	591	647	206	7	141	2	1592	4419	2115	742	237	1150	1	8644	10236	15
DELAWARE	425	150	92	1	165	222	1055	1792	851	347	124	791	1856	5741	6796	2
WASH.._D.C.	350	1335	2456	122	23	226	4512	2151	489	3016	871	17	15	6559	11071	5
FLORIDA	1501	1598	2406	80	156	624	6165	10498	8076	6519	1201	1290	3242	30826	36971	112
GEORGIA	1173	2159	77	141	366	592	4506	10353	6264	3237	1515	3100	2163	26652	31158	17
GUAM	79	23	0	0	0	2	104	455	358	2	0	0	123	958	1062	
HAWAII	441	658	213	5	210	58	1585	3201	1911	656	88	1966	414	8236	9821	19
IDAHO	412	92	46	3	176	5	732	2753	906	328	100	1162	24	5251	5983	
ILLINOIS	1053	2248	1014	154	429	482	5380	10316	11850	4563	1531	3144	2037	33441	38821	15
INDIANA	1222	964	179	20	291	200	2886	13789	6022	1688	695	2234	1501	25927	28813	6
IOWA	829	530	126	12	234	1	1732	7157	3987	1422	349	1873	0	14768	16500	
KANSAS	753	677	145	1154	275	14	3018	6421	3321	780	2385	2147	96	15150	18168	6
KENTUCKY	835	1262	96	10	147	1	2351	7046	6021	771	267	1025	2	15142	17493	12
LOUISIANA	1014	907	895	75	131	325	3347	10962	5055	3531	814	1475	2678	24515	27862	29
MAINE	382	222	202	3	163	6	978	2639	1306	900	96	1298	16	6255	7251	26
MARYLAND	1073	2392	597	27	526	502	5117	6524	6541	1396	411	2973	1790	19635	24752	43
MASSACHUSETTS	1173	1499	794	151	298	361	4256	9239	5266	3242	1249	2473	2264	23731	27987	65
MICHIGAN	1182	1052	563	55	371	193	3416	11757	7172	2872	1136	2614	1145	27696	31112	33
MINNESOTA	1051	1009	398	19	327	151	2955	9507	6722	1802	316	2139	960	21246	24201	9
MISSISSIPPI	1371	576	85	6	363	163	2544	11662	3328	605	238	2558	906	19295	21839	4
MISSOURI	1155	1830	477	96	407	156	4119	8647	6110	3167	4196	2510	1362	25990	30109	11
MONTANA	347	185	50	4	109	3	698	2597	1000	556	68	953	9	5163	5861	
NEBRASKA	484	381	87	1	154	117	1224	4281	2115	951	188	986	375	8894	10118	6
NEVADA	240	57	49	6	145	10	507	1158	461	445	160	954	54	3232	3739	
NEW_HAMPSHIRE	283	153	60	6	137	12	651	2097	1015	165	119	830	22	4248	4899	5
NEW_JERSEY	1367	1226	237	29	366	593	3918	10446	4459	1194	604	2408	2827	21938	25856	29
NEW_MEXICO	449	215	85	5	122	128	1004	3854	1225	467	98	955	222	6821	7825	6
NEW_YORK	2128	4300	1140	103	702	253	8626	17983	16915	5824	1925	5166	1283	49096	57722	114
NORTH_CAROLINA	1180	1500	368	66	197	131	3442	10929	6678	2142	902	1277	831	22759	26201	36
NORTH_DAKOTA	402	109	29	0	143	11	694	3555	819	311	0	982	35	5702	6396	
OHIO	1473	1512	593	46	605	1047	5276	13572	9711	3574	1180	5028	3459	36524	41800	31
OKLAHOMA	1040	1135	147	14	279	237	2852	7889	4629	832	526	2080	1396	17152	20004	
OREGON	769	197	226	31	236	119	1578	6799	1070	1480	395	1719	680	12143	13721	29

1DEPARTMENT_OF_DEFENSE
DEFENSE_MANPOWER — — — — — — STRENGTH_BY_STATE_(UNIT) — — — — — —
DATA_CENTER

— — — — — — SELECTED_RESERVE_STRENGTH

__AS_OF____SEPTEMBER_1988
__RUN__JANUARY____19,_1989
__REPORT_ A3   PAGE__02

STATE	OFFICERS							ENLISTED							_DOD _TOTAL	_EN&G _USCG
	__ARNG	__USAR	__USNR	__USMCR	__ANG	_USAFR	_TOTAL	__ARNG	__USAR	__USNR	__USMCR	__ANG	_USAFR	_TOTAL		
PENNSYLVANIA	1841	2621	1473	160	548	349	6992	15770	15223	6861	2101	4097	1835	45887	52879	29
PUERTO_RICO	797	561	0	2	0	0	1360	8932	5419	410	96	0	0	14857	16217	
RHODE_ISLAND	406	439	300	6	177	1	1329	2399	853	948	201	1242	1	5644	6973	14
SOUTH_CAROLINA	1166	933	402	18	133	452	3104	12780	4271	1825	590	1306	2651	23433	26537	16
SOUTH_DAKOTA	416	46	27	0	107	9	605	3892	427	276	0	851	23	5469	6074	
TENNESSEE	1550	933	632	67	545	3	3730	13218	4519	3274	1060	3316	0	25387	29117	23
TEXAS	1972	3427	1513	202	455	1196	8765	19694	14744	7343	2733	3419	6419	54356	63121	51
UTAH	903	533	92	3	183	252	1966	5557	2263	1012	146	1364	1855	12197	14163	8
VIRGINIA	956	3064	1591	90	198	1403	7302	8302	7452	5005	1074	1132	800	23765	31067	48
VIRGIN_ISLAND	97	0	0	0	0	0	97	839	0	0	0	0	0	839	936	
VERMONT	382	72	31	0	104	0	589	2802	453	150	0	856	0	4261	4850	6
WASHINGTON	698	1645	1021	78	243	426	4111	5937	6415	3856	910	2186	2274	21578	25689	74
WISCONSIN	1056	1322	222	20	266	145	3031	8404	7976	1947	465	1797	1064	21653	24664	18
WEST_VIRGINIA	401	229	69	7	308	0	994	3160	2976	653	183	1837	29	8838	9832	
WYOMING	239	6	16	0	160	6	427	1584	141	144	0	823	14	2706	3133	
OVERSEAS	0	199	77	0	151	101	528	0	325	1	0	1336	50	1712	2240	
SHIPS	0	0	693	0	0	0	693	0	0	4369	0	0	0	4369	5062	
UNKNOWN	5	2325	139	0	7	2405	4881	7	3362	1127	8	4	728	5236	10117	19
TOTAL	48216	59358	27804	3626	13960	16549	169513	406966	253467	121653	39950	101261	65567	988844	1158357	1208

1DEPARTMENT_OF_DEFENSE
DEFENSE_MANPOWER — — — — — STRENGTH_BY_STATE_(RESIDENCE_STATE_CODE) — — — — — —
DATA_CENTER

__AS_OF____SEPTEMBER_1988
__RUN__JANUARY____19,_1989
__REPORT_ A3   PAGE__03

```
            D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                                Q F A X

   +------------------------------------------------------------+
   |  |  Enlisted Retention              ->  FY88 now available  |
   |  |  Officer Retention               ->  FY88 now available  |
   |--+---------------------------------------------------------|
   |  |  Enlisted Management             ->  FY88 now available  |
   |  |  Officer Management              ->  FY88 now available  |
   |--+---------------------------------------------------------|
   |  |  Reserves                                               |
   | X ; Defense Civilians                                      |
   |  |  Enlisted Management             -> Old Version         |
   |  |  Accession Database                                     |
   |  |  Permanent Change of Station     -> Under Development    |
   |  |  Champus Database                -> Under Development    |
   |--+---------------------------------------------------------|
   |  |  Joint Uniform Military Pay System  -> FY88 now available |
   +--+---------------------------------------------------------+

   Use the Space Bar or Tab key to move the cursor to the desired topic,
   then type any character and press the ENTER key.   Press PF3 to quit.
```

```
   -------------------------------------------------------------------

        D E F E N S E    C I V I L I A N    R E P O R T I N G    S Y S T E M

                               Report Type

   -------------------------------------------------------------------



        X   Overall Demographic Summary
            Minority Group and Sex
            State and Country
            Major and Functional Occupational Group
            GS, GM and WG by Grade, Average Grade and Average Salary
            PATCO and Supervisory Ratios
            '718' Report - Occupational Distributions



   To make  your  selections  enter  any  character next  to  the desired  fields.
   When you have made your selections,  press  ENTER to continue,  or press one of
   the PF keys shown below for other functions.  For more information,  press PF1.

   -------------------------------------------------------------------
   1=HELP        2=NEW SET    3=QUIT        4=GO      5=FIRST PANEL    6=LAST PANEL
   7=BACKWARD    8=N/A        9=SUMMARY     10=N/A    11=SELECT ALL    12=NEGATE ALL
   -------------------------------------------------------------------
```

```
DEFENSE   CIVILIAN   REPORTING   SYSTEM

                        As Of Date
_____


                    X   30 Sep 1988
                        30 Jun 1988
                        31 Mar 1988
                        31 Dec 1987


            30 Sep 1987              30 Sep 1986
            30 Sep 1985              30 Sep 1984
            30 Sep 1983              30 Sep 1980
            30 Sep 1977              30 Sep 1974


To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions. For more information,  press PF1.
_____

1=HELP        2=NEW SET   3=QUIT        4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD    8=N/A       9=SUMMARY    10=N/A    11=SELECT ALL    12=NEGATE ALL
_____

Press PF4 if you have entered all of your selections. For a summary press PF9.
```

```
DEFENSE   CIVILIAN   REPORTING   SYSTEM

                      Pay Plan Coverage
_____


                        All Pay Plans
                        All White Collar
                        All Blue Collar
                        GS
                    X   GM
                        GS/GM Combined
                        WG
                        WG/WL/WS/WB Combined



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions. For more information,  press PF1.
_____

1=HELP        2=NEW SET   3=QUIT        4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD    8=N/A       9=SUMMARY    10=N/A    11=SELECT ALL    12=NEGATE ALL
_____

Press PF4 if you have entered all of your selections. For a summary press PF9.
```

```
========================================================================
      D E F E N S E   C I V I L I A N   R E P O R T I N G   S Y S T E M

                        Organizational Coverage
_____



                        All DoD
                        Army
                    X   Navy
                        Air Force
                        Defense Agencies Combined
                        Defense Agencies Individually




To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP        2=NEW SET    3=QUIT        4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=N/A        9=SUMMARY     10=N/A    11=SELECT ALL    12=NEGATE ALL
_____

Press PF4 if you have entered all of your selections. For a summary press PF9.
```

```
========================================================================
      D E F E N S E   C I V I L I A N   R E P O R T I N G   S Y S T E M

                      718 Report Selection Criteria
_____


Enter up to 30
Occupation Codes:   __ __ __ __ __ __ __ __ __ __
                    __ __ __ __ __ __ __ __ __ __
                    __ __ __ __ __ __ __ __ __ __


Enter up to 30
Occupation Groups:  __ __ __ __ __ __ __ __ __ __
                    __ __ __ __ __ __ __ __ __ __
                    __ __ __ __ __ __ __ __ __ __



When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP        2=NEW SET    3=QUIT        4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD    8=N/A        9=SUMMARY     10=N/A    11=ALL OCCS      12=NEGATE ALL
_____

After making your selections, you can press PF4 or PF16 to access the database.
```
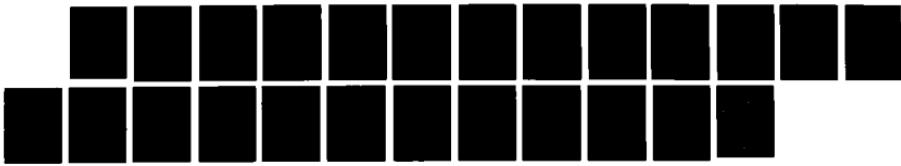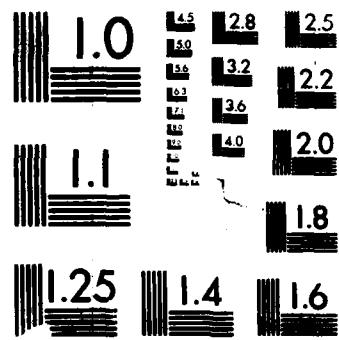
1 _ _ _
    _ _ _
0ORGANIZATION:__DEPARTMENT_OF_THE_NAVY
PAY_PLAN:_____GM
0 _ _

	PERMANENT			NON-PERMANENT			TOTAL		
	FULL TIME	PART TIME	TOTAL	FULL TIME	PART TIME	TOTAL	FULL TIME	PART TIME	TOTAL
0TOTAL_EMPLOYEES	21608	69	21677	31	15	46	21639	84	21723
OMB_CEILING	21568	38	21606	31	7	38	21599	45	21644
COMPETITIVE	20819	68	20887	20	12	32	20839	80	20919
EXCEPTED	789	1	790	11	3	14	800	4	804
WHITE_COLLAR	21608	69	21677	31	15	46	21639	84	21723
GS	0	0	0	0	0	0	0	0	0
GM	21608	69	21677	31	15	46	21639	84	21723
SES	0	0	0	0	0	0	0	0	0
OTHER_WHITE_COLLAR	0	0	0	0	0	0	0	0	0
PROFESSIONAL	12753	57	12810	21	11	32	12774	68	12842
ADMINISTRATIVE	8210	12	8222	10	4	14	8220	16	8236
TECHNICAL	633	0	633	0	0	0	633	0	633
CLERICAL	1	0	1	0	0	0	1	0	1
OTHER	9	0	9	0	0	0	9	0	9
GS/GM_SUPERVISORS	21608	69	21677	31	15	46	21639	84	21723
ENGINEERS	9567	27	9594	9	4	13	9576	31	9607
SCIENTISTS	1568	16	1584	6	2	8	1574	18	1592
BLUE_COLLAR	0	0	0	0	0	0	0	0	0
WG	0	0	0	0	0	0	0	0	0
WL	0	0	0	0	0	0	0	0	0
WS	0	0	0	0	0	0	0	0	0
WB	0	0	0	0	0	0	0	0	0
OTHER_BLUE_COLLAR	0	0	0	0	0	0	0	0	0
WG_SUPERVISORS	0	0	0	0	0	0	0	0	0
IN_U.S.	21338	69	21407	26	15	41	21364	84	21448
OVERSEAS	270	0	270	5	0	5	275	0	275
WASHINGTON_D.C._SMSA	10064	57	10121	7	9	16	10071	66	10137
MALE	19200	43	19243	27	15	42	19227	58	19285
FEMALE	2408	26	2434	4	0	4	2412	26	2438
MINORITY	2005	3	2008	4	0	4	2009	3	2012
NON-MINORITY	19603	66	19669	27	15	42	19630	81	19711
HANDICAPPED	851	0	851	2	1	3	853	1	854
RETIRED_MILITARY	745	1	746	2	0	2	747	1	748
VETERANS	8556	28	8584	22	9	31	8578	37	8615
MANAGEMENT_HOS	45	0	45	2	0	2	47	0	47
COOP_STUDENTS	42	0	42	0	0	0	42	0	42
COLLEGE_GRADS	17342	66	17408	28	12	40	17370	78	17448
ADVANCED_DEGREE	6318	34	6352	12	5	17	6330	39	6369
RETIREMENT_ELIGIBLE	1817	21	1838	12	8	20	1829	29	1858

```
        D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                            Q F A X
    ┌───────────────────────────────────────────────────────────┐
    │  │  │  Enlisted Retention         ->  FY88 now available │ │
    │  │  │  Officer Retention          ->  FY88 now available │ │
    ├──┼──┼──────────────────────────────────────────────────────┤
    │  │  │  Enlisted Management         ->  FY88 now available │ │
    │  │  │  Officer Management          ->  FY88 now available │ │
    ├──┼──┼──────────────────────────────────────────────────────┤
    │  │  │  Reserves                                            │
    │  │  │  Defense Civilians                                   │
    │  │  │  Enlisted Management         -> Old Version          │
    │ x│  │  Accession Database                                  │
    │  │  │  Permanent Change of Station -> Under Development     │
    │  │  │  Champus Database            -> Under Development     │
    ├──┼──┼──────────────────────────────────────────────────────┤
    │  │  │  Joint Uniform Military Pay System -> FY88 now available │
    └───────────────────────────────────────────────────────────┘

    Use the Space Bar or Tab key to move the cursor to the desired topic,
    then type any character and press the ENTER key.   Press PF3 to quit.
```

```
    ┌───────────────────────────────────────────────────────────┐
    │═══════════════════════════════════════════════════════════│
    │              A C C E S S I O N   D A T A   B A S E         │
    │                                                            │
    │                        Report Type                         │
    │───────────────────────────────────────────────────────────│
    │                                                            │
    │                                                            │
    │                                                            │
    │                   x   NPS Accessions                       │
    │                       NPS Contracts                        │
    │                                                            │
    │                                                            │
    │                                                            │
    │  To make your selections enter any character next to the desired fields. │
    │  When you have made your selections, press ENTER to continue, or press one of │
    │  the PF keys shown below for other functions. For more information, press PF1. │
    │───────────────────────────────────────────────────────────│
    │  1=HELP      2=N/A     3=QUIT     4=GO      5=FIRST PANEL   6=LAST PANEL │
    │  7=BACKWARD  8=N/A     9=SUMMARY  10=N/A    11=SELECT ALL   12=NEGATE ALL │
    └───────────────────────────────────────────────────────────┘
```

```
        A C C E S S I O N   D A T A   B A S E

                    Time Periods
_____


                      FY 87
                      FY 88 - Qtr 1
                      FY 88 - Qtr 2
                      FY 88 - Qtr 3
                  x   FY 88



To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP       2=N/A      3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD   8=N/A      9=SUMMARY   10=N/A    11=SELECT ALL   12=NEGATE ALL
_____
```

```
        A C C E S S I O N   D A T A   B A S E

                   Education Level
_____



                  Non High School
                  High School Senior (Contracts only)
              x   GED
                  High School Diploma Graduate
                  Total



To make your selections enter any character next to the desired fields.
When you have made your selections, press ENTER to continue, or press one of
the PF keys shown below for other functions. For more information, press PF1.
_____

1=HELP       2=N/A      3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
7=BACKWARD   8=N/A      9=SUMMARY   10=N/A    11=SELECT ALL   12=NEGATE ALL
_____

Panel 3 of 3  (After making selections, press PF4 to ACCESS or PF9 for SUMMARY)
```

RACE/APOT	DOD			ARMY			NAVY			AIR_FORCE			MARINE_CORPS		
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE
TOTAL_RACES															
I	11607	10202	1405	4293	3795	498	4044	3652	392	2123	1705	418	1157	1060	97
II	89997	77470	12527	32858	28402	4456	26737	23556	3181	18664	14721	3943	11738	10791	947
IIIA	61844	50719	11125	24680	20029	4651	15415	12691	2724	12393	9573	2730	9446	8426	1020
IIIB	75458	66767	8691	31421	26807	4614	26181	22920	3261	7007	6215	792	10849	10825	24
IV	13321	13279	42	4670	4665	5	8527	8491	36	43	42	1	81	81	0
UNK	1283	1072	211	204	179	25	829	684	145	236	195	41	14	14	0
TOTAL	253510	219509	34001	98116	83867	14249	81733	71994	9739	40376	32451	7925	33285	31197	2088
WHITE															
I	10981	9680	1301	4038	3574	464	3846	3483	363	2007	1623	384	1090	1000	90
II	78285	68260	10025	28006	24585	3421	23995	21386	2609	16173	12923	3250	10111	9368	743
IIIA	45595	38802	6793	17182	14725	2457	12201	10346	1855	9258	7354	1904	6954	6377	577
IIIB	43626	39647	3979	15789	14118	1671	15972	14252	1720	5388	4810	578	6477	6467	10
IV	6107	6092	15	1822	1822	0	4208	4193	15	32	32	0	45	45	0
UNK	736	575	161	145	133	12	388	269	119	196	166	30	7	7	0
TOTAL	185323	163054	22274	66982	58955	8027	60610	53929	6681	33052	26906	6146	24684	23264	1420
BLACK															
I	327	259	68	127	107	20	99	79	20	67	44	23	34	29	5
II	8334	6355	1979	3512	2685	827	2006	1545	461	1791	1249	542	1025	876	149
IIIA	12939	9211	3728	6118	4192	1926	2653	1884	769	2334	1654	680	1834	1481	353
IIIB	26797	22638	4159	13494	10866	2628	8811	7455	1356	1225	1061	166	3267	3256	11
IV	6176	6153	23	2447	2443	4	3692	3674	18	7	6	1	30	30	0
UNK	175	134	41	48	40	8	89	66	23	32	22	10	6	6	0
TOTAL	54748	44750	9998	25746	20333	5413	17350	14703	2647	5456	4036	1420	6196	5678	518
OTHER_RACES															
I	299	263	36	118	104	14	99	90	9	49	38	11	33	31	2
II	3378	2855	523	1340	1134	206	736	625	111	700	549	151	602	547	55
IIIA	3310	2706	604	1380	1112	268	561	461	100	711	565	146	658	568	90
IIIB	5035	4482	553	2138	1823	315	1398	1213	185	394	344	50	1105	1102	3
IV	1038	1034	4	401	400	1	627	624	3	4	4	0	6	6	0
UNK	374	365	9	11	6	5	352	349	3	10	9	1	1	1	0
TOTAL	13434	11705	1729	5388	4579	809	3773	3362	411	1868	1509	359	2405	2255	150

90

```
              D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                                  ·  Q F A X

+--------+---------------------------------------------------------------+
|  |     |  Enlisted Retention              ->  FY88 now available       |
|  |     |  Officer Retention               ->  FY88 now available       |
|--+-----+---------------------------------------------------------------|
|  |     |  Enlisted Management             ->  FY88 now available       |
|  |     |  Officer Management              ->  FY88 now available       |
|--+-----+---------------------------------------------------------------|
|  |     |  Reserves                                                     |
|  |     |  Defense Civilians                                            |
|  |     |  Enlisted Management             ->  Old Version              |
|  |     |  Accession Database                                           |
|  | x   |  Permanent Change of Station     ->  Under Development         |
|  |     |  Champus Database                ->  Under Development         |
|--+-----+---------------------------------------------------------------|
|  |     |  Joint Uniform Military Pay System  ->  FY88 now available    |
+--------+---------------------------------------------------------------+

      Use the Space Bar or Tab key to move the cursor to the desired topic,
      then type any character and press the ENTER key.   Press PF3 to quit.
```

```
  P E R M A N E N T   C H A N G E   O F   S T A T I O N   D A T A   B A S E

                                  Main Menu
  _____


                    x   Tour Length Information
                        Weight and Cost Information




  Budget categories -ACCESSION and TRAINING - are not used on Tour Length study.


  _____

  To make  your  selections  enter  any  character next  to  the desired  fields.
  When you have made your selections,  press  ENTER to continue,  or press one of
  the PF keys shown below for other functions. For more information,  press PF1.
  _____

  1=HELP         2=N/A        3=QUIT        4=GO        5=FIRST PANEL    6=LAST PANEL
  7=BACKWARD     8=N/A        9=SUMMARY     10=N/A      11=SELECT ALL    12=NEGATE ALL
  _____

                  Please select the desired categories.
```

```
╔════════════════════════════════════════════════════════════╗
║  ┌──────────────────────────────────────────────────────┐  ║
║  │  ═══════════════════════════════════════════════════ │  ║
║  │  P E R M A N E N T   C H A N G E   O F   S T A T I O N  D A T A   B A S E │
║  │                                                      │  ║
║  │                    Fiscal Year                       │  ║
║  │  ═══════════════════════════════════════════════════ │  ║
║  │                                                      │  ║
║  │                                                      │  ║
║  │                    x   FY 87                         │  ║
║  │                        FY 86                         │  ║
║  │                                                      │  ║
║  │  To make your selections enter any character next to the desired fields. │
║  │  When you have made your selections, press ENTER to continue, or press one of │
║  │  the PF keys shown below for other functions. For more information, press PF1. │
║  │  ═══════════════════════════════════════════════════ │  ║
║  │  1=HELP      2=N/A     3=QUIT     4=GO      5=FIRST PANEL   6=LAST PANEL │
║  │  7=BACKWARD  8=N/A     9=SUMMARY  10=N/A    11=SELECT ALL   12=NEGATE ALL │
║  │  ═══════════════════════════════════════════════════ │  ║
║  └──────────────────────────────────────────────────────┘  ║
╚════════════════════════════════════════════════════════════╝
```

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╔════════════════════════════════════════════════════════════╗
║  ┌──────────────────────────────────────────────────────┐  ║
║  │  ═══════════════════════════════════════════════════ │  ║
║  │  P E R M A N E N T   C H A N G E   O F   S T A T I O N  D A T A   B A S E │
║  │                                                      │  ║
║  │  TOUR LENGTH STUDY ─────────── Service selection     │  ║
║  │  ═══════════════════════════════════════════════════ │  ║
║  │                                                      │  ║
║  │                    DoD Total                         │  ║
║  │                    Army                              │  ║
║  │                    Navy Sea Duty                     │  ║
║  │                    Navy Shore Duty                   │  ║
║  │                x   Navy Total                        │  ║
║  │                    Marine Corps                      │  ║
║  │                    Air Force                         │  ║
║  │                                                      │  ║
║  │  To make your selections enter any character next to the desired fields. │
║  │  When you have made your selections, press ENTER to continue, or press one of │
║  │  the PF keys shown below for other functions. For more information, press PF1. │
║  │  ═══════════════════════════════════════════════════ │  ║
║  │  1=HELP      2=N/A     3=QUIT     4=GO      5=FIRST PANEL   6=LAST PANEL │
║  │  7=BACKWARD  8=N/A     9=SUMMARY  10=N/A    11=SELECT ALL   12=NEGATE ALL │
║  │  ═══════════════════════════════════════════════════ │  ║
║  └──────────────────────────────────────────────────────┘  ║
╚════════════════════════════════════════════════════════════╝
```

92

```
┌────────────────────────────────────────────────────────────────┐
│                                                                │
│  P E R M A N E N T   C H A N G E   O F   S T A T I O N   D A T A   B A S E │
│                                                                │
│       TOUR LENGTH STUDY ───────► PAY GRADE SELECTION           │
│  ──────────────────────────────────────────────────────────    │
│                                                                │
│                            ALL                                 │
│                            ALL ENLISTED                        │
│                            ALL WARRANT OFFICERS                │
│                        x   ALL OFFICERS                        │
│                                                                │
│   E1      E2      E3      E4      E5      E6      E7      E8      E9  │
│   W1      W2      W3      W4                                    │
│   O1      O2      O3      O4      O5      O6      O7      O8      O9  │
│   O10                                                          │
│                                                                │
│  TO MAKE  YOUR  SELECTIONS  ENTER  ANY  CHARACTER NEXT  TO  THE DESIRED  FIELDS. │
│  WHEN YOU HAVE MADE YOUR SELECTIONS.  PRESS  ENTER TO CONTINUE,  OR PRESS ONE OF │
│  THE PF KEYS SHOWN BELOW FOR OTHER FUNCTIONS.  FOR MORE INFORMATION.  PRESS PF1. │
│  ──────────────────────────────────────────────────────────    │
│  1=HELP       2=NEW SET    3=QUIT     4=GO     5=FIRST PANEL   6=LAST PANEL │
│  7=BACKWARD   8=FORWARD    9=SUMMARY  10=MAIN  11=SELECT ALL   12=NEGATE ALL │
│  ──────────────────────────────────────────────────────────    │
└────────────────────────────────────────────────────────────────┘

┌────────────────────────────────────────────────────────────────┐
│                                                                │
│  P E R M A N E N T   C H A N G E   O F   S T A T I O N   D A T A   B A S E │
│                                                                │
│    tour length study ─── location of losing station selection  │
│  ──────────────────────────────────────────────────────────    │
│                                                                │
│                        x   Total                               │
│                            CONUS                               │
│                            Overseas                            │
│                                                                │
│  To make  your  selections  enter  any  character next  to  the desired  fields. │
│  When you have made your selections,  press  ENTER to continue,  or press one of │
│  the PF keys shown below for other functions.  For more information,  press PF1. │
│  ──────────────────────────────────────────────────────────    │
│  1=HELP       2=N/A       3=QUIT     4=GO     5=FIRST PANEL   6=LAST PANEL │
│  7=BACKWARD   8=N/A       9=SUMMARY  10=N/A   11=SELECT ALL   12=NEGATE ALL │
│  ──────────────────────────────────────────────────────────    │
│  PRESS PF4 IF YOU HAVE ENTERED ALL OF YOUR SELECTIONS. FOR A SUMMARY PRESS PF9. │
└────────────────────────────────────────────────────────────────┘
```

93

```
PERMANENT   CHANGE   OF   STATION   DATA   BASE

   TOUR LENGTH STUDY ———— PCS Dependency Status selection
_____

                        x   Total
                            Unaccompanied with Dependents
                            Unaccompanied without Dependents
                            Accompanied



note: Only the -TOTAL- option applies for the CONUS option on the
      previous panel.



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

I=HELP         2=N/A     3=QUIT       4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD     8=N/A     9=SUMMARY    10=N/A      11=SELECT ALL    12=NEGATE ALL
_____

PRESS PF4 IF YOU HAVE ENTERED ALL OF YOUR SELECTIONS. FOR A SUMMARY PRESS PF9.
```

```
PERMANENT   CHANGE   OF   STATION   DATA   BASE

   Weight and Cost Study ——— Budget Move Category selection
_____

                            Total
                            Accession
                            Training
                            Operational
                        x   Rotational
                            Separation
                            Unit



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

I=HELP         2=N/A     3=QUIT       4=GO        5=FIRST PANEL    6=LAST PANEL
7=BACKWARD     8=N/A     9=SUMMARY    10=N/A      11=SELECT ALL    12=NEGATE ALL
_____
```

1
0PAY GRADE OF--   003   TOUR LENGTH _ _   FY87;
  LOCATION _ _   TOTAL
  SERVICE   NAVY TOTAL
  ACCOMPANIED STATUS -   TOTAL
                           PRESCRIBED D_TOUR LENGTH

DEVIATION IN MONTHS	<12 MONTHS		12-23 MONTHS		24-35 MONTHS		36-47 MONTHS		48+ MONTHS		TOT
	#	%	#	%	#	%	#	%	#	%	#
OVER 12=	0	.0	0	.0	0	.0	1493	36.5	0	.0	1493
7-12 LESS	0	.0	0	.0	0	.0	904	22.1	0	.0	904
3-6 LESS	0	.0	0	.0	0	.0	384	9.4	0	.0	384
FULL +/-2	1	.0	0	.0	0	.0	614	15.0	0	.0	615
3-6 MORE	4	.0	0	.0	0	.0	335	8.2	0	.0	339
7-12 MORE	34	.6	0	.0	0	.0	176	4.3	0	.0	210
OVER 12+	5150	99.2	0	.0	0	.0	174	4.2	0	.0	5324
TOTAL #	5,139		0		0		4,080		0		9269
AVG DEV	31		0		0		-8		0		14

1
0PAY GRADE OF--   004   TOUR LENGTH _ _   FY87;
  LOCATION _ _   TOTAL
  SERVICE   NAVY TOTAL
  ACCOMPANIED STATUS -   TOTAL
                           PRESCRIBED D_TOUR LENGTH

DEVIATION IN MONTHS	<12 MONTHS		12-23 MONTHS		24-35 MONTHS		36-47 MONTHS		48+ MONTHS		TOT
	#	%	#	%	#	%	#	%	#	%	#
OVER 12=	0	.0	0	.0	0	.0	651	24.5	0	.0	651
7-12 LESS	0	.0	0	.0	0	.0	593	22.3	0	.0	593
3-6 LESS	0	.0	0	.0	0	.0	258	9.7	0	.0	258
FULL +/-2	0	.0	0	.0	0	.0	515	19.4	0	.0	515
3-6 MORE	3	.1	0	.0	0	.0	252	9.5	0	.0	255
7-12 MORE	22	.8	0	.0	0	.0	156	5.3	0	.0	178
OVER 12+	2555	99.0	0	.0	0	.0	227	8.5	0	.0	2782
TOTAL #	2,580		0		0		2,652		0		5232
AVG DEV	28		0		0		-4		0		12

1
0PAY GRADE OF--   TOTAL   _ _ WEIGHT AND COST   FY87;
   BUDGET MOVE CATEGORY--   TOTAL
   TYPE OF MOVE--   TOTAL

	ARMY	NAVY SEA	NAVY SHORE	NAVY TOTAL	MC	AF	TOTAL
OVERSEAS		**✻ ACCMPND**		**✻**		**✻**	
TOT NUMBR	39,521	3,198	1,543	4,741	4,778	4,213	53,253
NUMBER	32,727	2,063	805	2,868	2,730	3,412	41,737
AVG WEIGHT	4199	3966	4191	4029	4606	4805	4263
COST 1000S	73,513	5,336	1,933	7,269	8,551	10,161	99,495
AVG COST	2246	2587	2402	2535	3132	2978	2384
AVG COST/LB	0.53	0.65	0.57	0.63	0.68	0.62	0.56
OVERSEAS		**✻ UNACCMPND**		**✻ WITHOUT DEPENDENTS ✻**			
TOT NUMBR	2,945	0	0	0	20,661	1,632	25,238
NUMBER	1,307	0	0	0	8,492	1,454	11,753
AVG WEIGHT	1374	0	0	0	1445	5305	1912
COST 1000S	1,299	0	0	0	6,095	4,799	12,194
AVG COST	719	0	0	0	718	3301	1038
AVG COST/LB	0.52	0.00	0.00	0.00	0.50	0.62	0.54

1
0PAY GRADE OF--   TOTAL   _ _ WEIGHT AND COST   FY87;
   BUDGET MOVE CATEGORY--   TOTAL
   TYPE OF MOVE--   TOTAL

	ARMY	NAVY SEA	NAVY SHORE	NAVY TOTAL	MC	AF	TOTAL
OVERSEAS		**✻ UNACCMPND**		**✻ WITH DEPENDENTS**		**✻**	
TOT NUMBR	31,645	3,019	690	3,709	0	1,988	37,342
NUMBER	22,614	533	89	622	0	1,756	24,992
AVG WEIGHT	2205	1623	1919	1665	0	3132	2257
COST 1000S	24,336	580	79	660	0	2,855	28,351
AVG COST	1098	1089	898	1062	0	1626	1134
AVG COST/LB	0.50	0.67	0.47	0.64	0.00	0.52	0.50
OVERSEAS		**✻ UNKNOWN**		**✻**		**✻**	
TOT NUMBR	59,425	28,174	9,784	37,958	0	78,834	176,217
NUMBER	39,741	11,405	3,671	15,076	0	68,377	123,194
AVG WEIGHT	1257	3950	4266	4027	0	3709	2957
COST 1000S	27,510	25,638	9,148	34,787	0	144,539	206,337
AVG COST	692	2248	2492	2307	0	2114	1679
AVG COST/LB	0.55	0.57	0.58	0.57	0.00	0.57	0.57

1
0PAY GRADE OF--   TOTAL   _ _ WEIGHT AND COST   FY87;
   BUDGET MOVE CATEGORY--   TOTAL
   TYPE OF MOVE--   TOTAL

	ARMY	NAVY SEA	NAVY SHORE	NAVY TOTAL	MC	AF	TOTAL
		✻ CONUS		**✻**		**✻**	
TOT NUMBR	181,888	165,548	89,993	255,541	63,506	119,705	620,640
NUMBER	41,204	24,914	17,230	42,144	9,316	44,943	137,607
AVG WEIGHT	2971	4292	4549	4397	3877	3986	3801
COST 1000S	61,894	46,026	33,029	79,055	14,563	99,992	255,510
AVG COST	1502	1847	1917	1876	1564	2225	1857
AVG COST/LB	0.51	0.43	0.42	0.43	0.40	0.56	0.49
		✻ TOTAL		**✻**		**✻**	
TOT NUMBR	315,424	199,939	102,010	301,949	88,945	206,372	912,690
NUMBER	138,093	38,915	21,795	60,710	20,538	119,942	339,283
AVG WEIGHT	2622	4138	4477	4260	2968	3855	3372
COST 1000S	189,053	77,581	44,190	121,772	29,214	262,348	602,388
AVG COST	1369	1994	2028	2006	1422	2187	1775
AVG COST/LB	0.52	0.48	0.45	0.47	0.48	0.57	0.53

```
              D e f e n s e    M a n p o w e r    D a t a    C e n t e r

                             Q F A X

        +---------------------------------------------------------------+
        |  |  Enlisted Retention            ->  FY88 now available  |
        |  |  Officer Retention             ->  FY88 now available  |
        |--+------------------------------------------------------------|
        |  |  Enlisted Management           ->  FY88 now available  |
        |  |  Officer Management            ->  FY88 now available  |
        |--+------------------------------------------------------------|
        |  |  Reserves                                              |
        |  |  Defense Civilians                                     |
        |  |  Enlisted Management           -> Old Version          |
        |  |  Accession Database                                    |
        |  |  Permanent Change of Station   -> Under Development     |
        |  |  Champus Database              -> Under Development     |
        |--+------------------------------------------------------------|
        | x|  Joint Uniform Military Pay System  ->  FY88 now available |
        +---------------------------------------------------------------+

     Use the Space Bar or Tab key to move the cursor to the desired topic,
     then type any character and press the ENTER key.   Press PF3 to quit.
```

```
    ===================================================================

                    J U M P S    D A T A    B A S E

                       Primary Selection Menu
    -------------------------------------------------------------------


                    x    Pay Grade
                         Race
                         Sex
                         Marital Status
                         No. of Dependents
                         Service
                         Years of Service
                         Time in Grade



    To make  your  selections  enter  any  character next  to  the desired  fields.
    When you have made your selections,  press  ENTER to continue,  or press one of
    the PF keys shown below for other functions.  For more information,  press PF1.
    -------------------------------------------------------------------
    1=HELP        2=NEW SET    3=QUIT      4=GO      5=FIRST PANEL   6=LAST PANEL
    7=BACKWARD    8=FORWARD    9=SUMMARY   10=MAIN   11=SELECT ALL   12=NEGATE ALL
    ===================================================================
```

97

```
              J U M P S   D A T A   B A S E

                        Pay Grade
_____

                          Total

  E1      E2      E3      E4      E5      E6      E7      E8      E9
  Enlisted Totals


  WO      01      02      03    x 04      05      06      Gen'l Officer
  Officer Totals



To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP       2=NEW SET    3=QUIT       4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD   8=FORWARD    9=SUMMARY    10=MAIN   11=SELECT ALL    12=NEGATE ALL
```

```
              J U M P S   D A T A   B A S E

                      Marital Status
_____




                        Total
                        Single
                   x    Married
                        Previously Married




To make  your  selections  enter  any  character next  to  the desired  fields.
When you have made your selections,  press  ENTER to continue,  or press one of
the PF keys shown below for other functions.  For more information,  press PF1.
_____

1=HELP       2=NEW SET    3=QUIT       4=GO      5=FIRST PANEL    6=LAST PANEL
7=BACKWARD   8=FORWARD    9=SUMMARY    10=MAIN   11=SELECT ALL    12=NEGATE ALL
```

```
┌─────────────────────────────────────────────────────────────┐
│ ══════════════════════════════════════════════════════════  │
│                                                               │
│               J U M P S   D A T A   B A S E                   │
│                                                               │
│                     Years of Service                          │
│ ─────────────────────────────────────────────────────────    │
│                                                               │
│                                                               │
│                           Total                               │
│                                                               │
│    01      02      03      04     05     06     07     08     09     10   │
│    11      12   x  13      14     15     16     17     18     19     20   │
│    21      22      23      24     25     26     27     28     29     30   │
│                                                               │
│                         31 or more                            │
│                                                               │
│                                                               │
│  To make your selections enter any character next to the desired fields.  │
│  When you have made your selections, press ENTER to continue, or press one of  │
│  the PF keys shown below for other functions. For more information, press PF1.  │
│ ─────────────────────────────────────────────────────────    │
│  1=HELP       2=NEW SET   3=QUIT     4=GO      5=FIRST PANEL    6=LAST PANEL  │
│  7=BACKWARD   8=FORWARD   9=SUMMARY  10=MAIN   11=SELECT ALL    12=NEGATE ALL  │
│ ═══════════════════════════════════════════════════════════  │
└─────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────┐
│ ══════════════════════════════════════════════════════════  │
│                                                               │
│               J U M P S   D A T A   B A S E                   │
│                                                               │
│                      Time in Grade                            │
│ ─────────────────────────────────────────────────────────    │
│                                                               │
│                      Total                                    │
│                      6 months or less                         │
│                      7 months to 1 year                       │
│                      2 years                                  │
│                      3 years                                  │
│                      4 years                                  │
│                      5 years                                  │
│                   x  6 years or more                          │
│                                                               │
│                                                               │
│  To make your selections enter any character next to the desired fields.  │
│  When you have made your selections, press ENTER to continue, or press one of  │
│  the PF keys shown below for other functions. For more information, press PF1.  │
│ ─────────────────────────────────────────────────────────    │
│  1=HELP       2=NEW SET   3=QUIT     4=GO      5=FIRST PANEL    6=LAST PANEL  │
│  7=BACKWARD   8=FORWARD   9=SUMMARY  10=MAIN   11=SELECT ALL    12=NEGATE ALL  │
│ ═══════════════════════════════════════════════════════════  │
└─────────────────────────────────────────────────────────────┘
```

```
┌──────────────────────────────────────────────────────────┐
│  ┌────────────────────────────────────────────────────┐  │
│  │                                                    │  │
│  │          J U M P S   D A T A   B A S E             │  │
│  │                                                    │  │
│  │         Population / JUMPS Pay Component           │  │
│  │  ──────────────────────────────────────────────    │  │
│  │   Population Count          (Reserved for future use) │
│  │   Base Pay                  Special Pay Adjustments   │
│  │   Officer Med/Dental Special Pay Adj.  Non-US Duty Pay│
│  │   Proficiency Pay           Imminent Danger Pay       │
│  │   Diving Duty Pay           Responsibility Pay        │
│  │   Overseas Extension Pay    Hazardous Duty Pay        │
│  │ x Aviation Career Incentive Pay  Aviation Officer Continuation Pay│
│  │   Dental Officer Continuation Pay  Medical Duty Pay   │
│  │   Nuclear Occupation Pay    Enlistment Bonus          │
│  │   Selective Reenlistment Bonus  Regular Reenlistment Bonus│
│  │   Housing-related Supplements  Personnel & Family-related Supplmnts│
│  │                                                    │  │
│  │ To make your selections enter any character next to the desired fields.│
│  │ When you have made your selections. press ENTER, PF4 or PF16 to continue, or│
│  │ press one of the PF keys shown below for other functions.│
│  │  ──────────────────────────────────────────────    │  │
│  │        3=QUIT    11=SELECT ALL   12=NEGATE ALL     │  │
│  │  ──────────────────────────────────────────────    │  │
│  └────────────────────────────────────────────────────┘  │
└──────────────────────────────────────────────────────────┘
```

```
┌──────────────────────────────────────────────────────────┐
│  ┌────────────────────────────────────────────────────┐  │
│  │                                                    │  │
│  │          J U M P S   D A T A   B A S E             │  │
│  │                                                    │  │
│  │                  Time Series                       │  │
│  │  ──────────────────────────────────────────────    │  │
│  │                                                    │  │
│  │                                                    │  │
│  │                                                    │  │
│  │     x   FY88       FY87       FY86       FY85      │  │
│  │         FY84       FY83       FY82       FY81      │  │
│  │         FY80       FY79       FY78                 │  │
│  │                                                    │  │
│  │       NOTE- Data previous to FY84 are not available.│ │
│  │                                                    │  │
│  │ To make your selections enter any character next to the desired fields.│
│  │ When you have made your selections, press ENTER, PF4 or PF16 to continue, or│
│  │ press one of the PF keys shown below for other functions.│
│  │  ──────────────────────────────────────────────    │  │
│  │     1=HELP    3=QUIT    11=SELECT ALL    12=NEGATE ALL│ │
│  │  ──────────────────────────────────────────────    │  │
│  └────────────────────────────────────────────────────┘  │
└──────────────────────────────────────────────────────────┘
```

```
ALL_PAY_IS_IN_THOUSANDS)
POPULATIONS_ARE_IN_UNITS)
EX:   MARITAL_STAT: SERVICE: POP._OR_COMPENSATION: FY_87 FY_88
EMALE SINGLE         NAVY      POPULATION_COUNT        32722 33554
```

INTENTIONALLY LEFT BLANK

APPENDIX B
MAJOR SOFTWARE ON IBM 3033/4381 NETWORK

1. PROGRAMMING LANGUAGES

MVS/JES3 Batch	*VM-370/CMS*
VS Fortran	VS Fortran
	WATFOR-77 (WATCOM)
VS COBOL	VS COBOL
PL/1 Optimizer	PL/CT (Cornell U.)
Assembler F	Assembler F
BASIC (U. of Waterloo)	BASIC
Pascal (U. of Waterloo)	Pascal (U. of Waterloo)
Pascal VS	Pascal VS
REDUCE 3.0 (Rand Corp.)	REDUCE 3.0
ALGOLW (Stanford)	VS APL

2. ADDITIONAL SOFTWARE RESOURCES

SIMULATION

Continuous:	CSMP-III	Cont. Simulation Modeling Package (IBM)
	DSL./VS	Dynamic Simulation Language (IBM)
Discrete:	GPSS-V	General Purpose Simulation System (IBM)
	SIMSCRIPT 11.5	Simulation Language (CACI)

STATISTICS

BMDP	Biomedical Computing Package (BMDP Statistical Software, Inc.)
MINITAB	Interactive Statistical Computing (Minitab, Inc.)
SPSSX	Statistical Programs for the Social Sciences (SPSS, Inc.)
SAS	Statistical Analysis System (SAS Institute)

GENERAL LIBRARIES

IMSL   International Mathematical & Statistical (IMSL)
Harwell   Subroutine Library – AERE Herwell (England)
Netlib   Argonne Libraries – available via BITNEt

SPECIALIZED MATHEMATICS

EISPACK   Eigensystem Package (Argonne Lab.)
ITPACK   Sparse Matrix Operations (Univ. of Texas/Boeing)
LINPACK   Linear Systems Package (Argonne Lab.)
MPSIII   Linear Programming Package (Ketron, Inc.)

TEXT PROCESSING

SCRIPTVS/DCF   Text/Document Processing (IBM)

GRAPHICS

TELLAGRAF   Graphics System (ISSCO, Inc.)
DISSPLA   Graphics Package (ISSCO, Inc.)
NCAR   Natl. Center for Atmospheric Research Package
Versaplot   Graphics Programming Package (Versatec)
IPG   Interactive Presentation Graphics (IBM)
GRAPHSTAT   APL-Based Interactive Statistics/Graphics (IBM)
GDDM   Graphic Data Display Manager (IBM)

ENGINEERING

IODE   Interactive Ordinary Differential Equations
COMPACT   Optimization of Circuits (Compace Engineering, Inc.)

ACCOUNTING AND CONTROL

BDBF   Billing Data Base Facility (Duquesne)
RESLIM   VM/370 Resource Limiter (IBM)

OTHERS

DFDSS   Data Facility Data Set Services (IBM)
SYNCSORT   Sorting Program (Whitlow)
PTU   Princeton Tape Utility
DMS   Display Management System (IBM)
FOCUS   Data Management System (Information Builders)
DIM3278   Protocol Converter used with SIM/PC on micros
                  (SIMWARE)

APPENDIX C

EQUIPMENT IN IBM 3033/4381 NETWORK
W. R. CHURCH COMPUTER CENTER

PROCESSORS AND ASSOCIATED EQUIPMENT

1	IBM	3033-A16	Central Processor Unit (16 Mbytes)
1		3042-1	Attached Processor Unit
1		3033-U16	Central Processor Unit (16 Mbytes)
1		4381-Q13	Processor (24 Mbytes)
1		3038-1	Multiprocessor Communications Unit
1		3088-1	Multi-System Channel Communications Unit

DRUMS

2	IBM	2835-2	Drum Storage Control
4		2305-2	Drum Storage (12 Mbytes each)

DISKS

4	IBM	3880-3	Disk Storage Control
2		3830-2	Disk Storage Control
4		3350-A2X	Disk Storage & Control (2 spindles @ 317.5 Mbytes each)
1		23350-B2X	Disk Storage
4		3380-AE4	Disk Storage (5 Gbytes each)
5		3380-BE4	Disk Storage ← QFAX ON-LINE DATA STORAGE

TAPES

1	IBM	3803-2	Tape Control
9		3420-8	Tape Drives (9-track, 6250 bpi)
1		3420-7	Tape Drive (9-track, 1600 bpi)
1		3480-A22	Tape Control
3		3480-B22	Tape Unit (18-track, cartridge)
15		53480-B22	Tape Unit (18-track, cartridge) for DMDC use)

TERMINALS/COMMUNICATIONS *(Center and Public Devices Only)*

2	IBM	3174-IL	Control Unit (max 32 Terminals each)
15		3274	Control Unit (max 32 Terminals each)
8		53278-2	Displays (EBCDIC)
30		3278-2	Displays (APL/EBCDIC)
18		3277-2GA	Graphics (3277/Tek 618 Dual Screen)
4		3279-S3G	Display (color)
4		3290-1	Display (plasma)
1		3705-G2	Communications Controller
1		3720-1	Communications Controller
6	Tek	4631	Hard-copy Units

NPS SUPPORT:

Dial-up 3@ 2400 bpsASCII
16@ 1200 bps"
10@ 300 bps"

Hard-wired 3@4800 bpsIBM 3276s, RJE
16@2400 bpsGraphics
2@1200 bpsDecwriters
1@19200 bpsRemote 3777/3203
1@9600 bpsBITNET

INPUT/OUTPUT DEVICES

1	IBM	3800-3	Page Printer
1		3777-1	Communications Terminal
1		3202-3	Line Printer (remote)
7		3262-3	Remote Printer (3278-compatible)
1	VERS	820 RPM	Plotter Controller
1		7422	Electrostatic Printer.Plotter (22 inch)
1		900-A	Plotter (8-inch)

IBM 4381-Q13 CONFIGURATION

Notes : Pri/Opt ch x = Primary/optional channel @x.

106
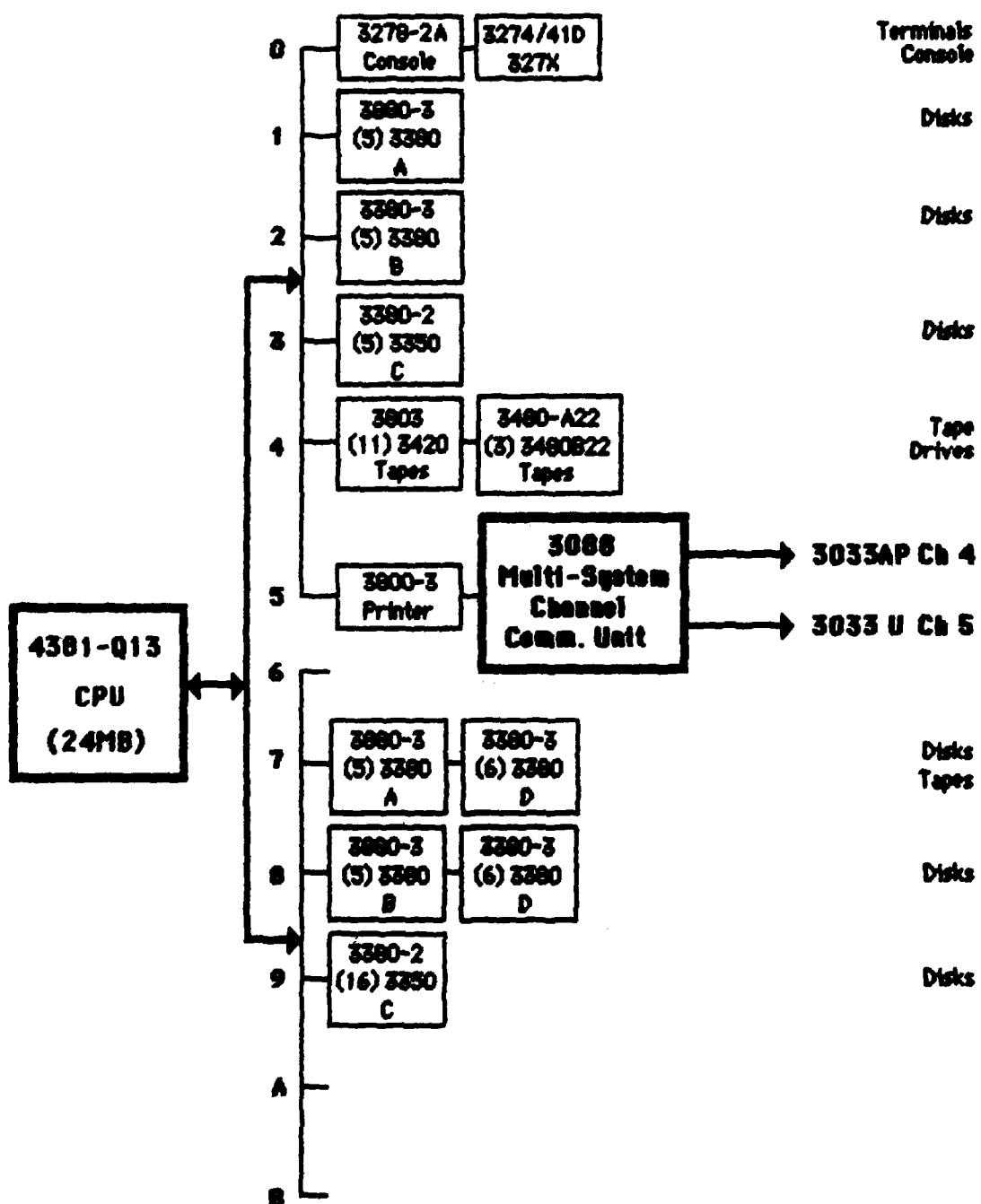
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